Gas Journal

VOL. 294. 110th YEAR. LONDON, JUNE 4, 1958 No 4951 PRICE 1/6

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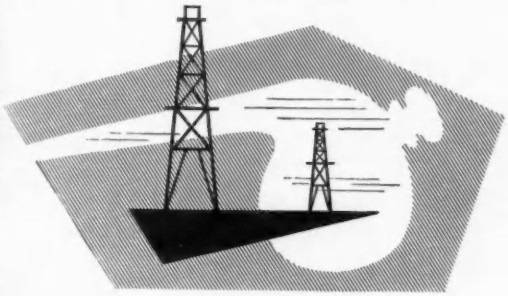

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Gas Journal

VOL. 294 NO. 4951 4 JUNE, 1958

110TH YEAR

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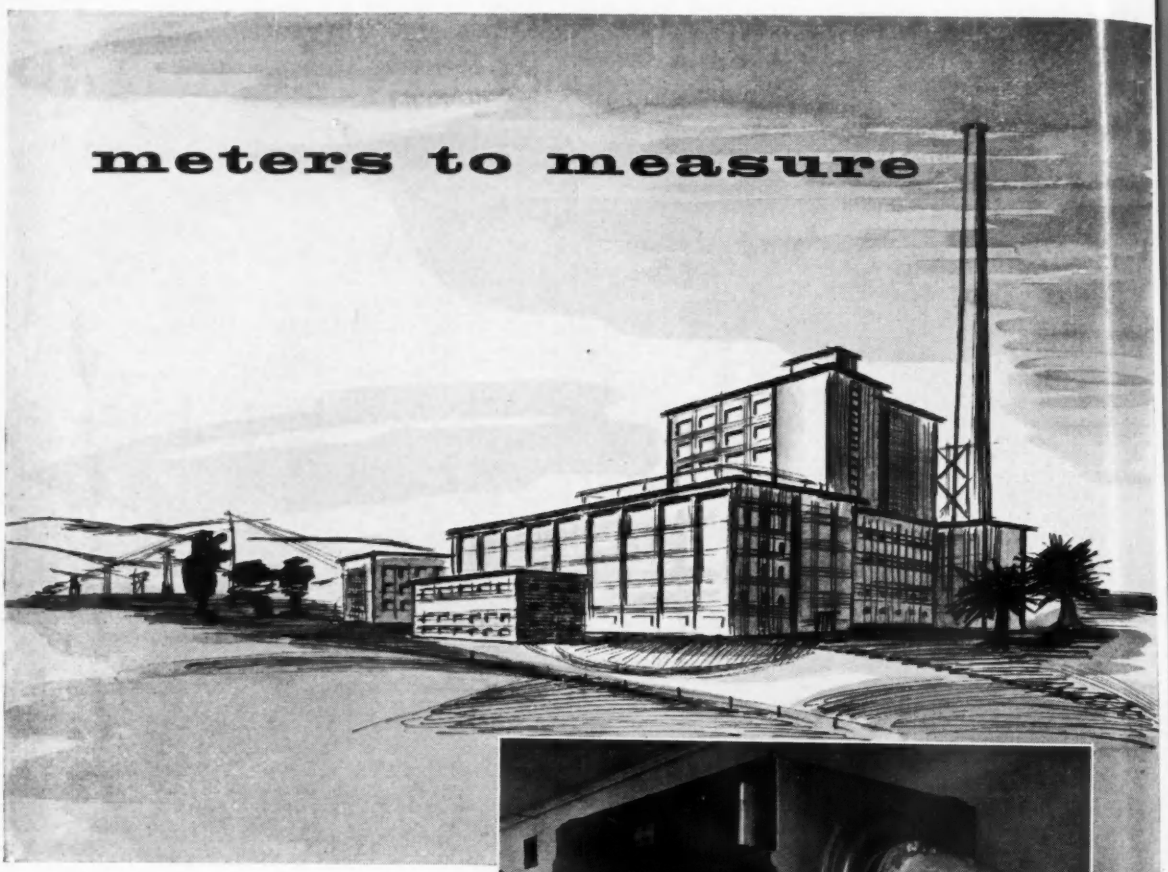

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Gas Journal

VOLUME 294. No. 4951. JUNE 4, 1958. 110th YEAR

Gas Production from Larger Units

IN his Chairman's address to the London and Southern Section of the Institution, Mr. C. Stott gives a very clear indication of how the gas industry will have to develop in future years if it is going to improve its competitive position for the supply of fuel to the community.

After vesting day the industry had to face certain problems which many had either not recognised or had been unwilling to recognise before. Under the new regime and with the new organisation, the future prospects of the industry were practically transformed overnight. No longer was it to be hampered by a number of small manufacturing units supplying rigidly confined areas allotted to specified undertakings by their particular Acts of Parliament.

The benefits to be gained from the wider horizons were quickly appreciated by the area gas boards so that when consideration had to be given to the rebuilding of small works, in whatever state of repair they might be, the most modern economic thinking could be applied. The gas industry as a whole, therefore, for about the first time in its long history, could plan its future with the assurance of big business. In this way the industry as we know it today has evolved during the last nine years, but if it is going to improve its position, the tendencies towards larger manufacturing units will have to be developed even further.

Mr. Stott quotes the accepted figures for energy requirements forecast for 1965 and 1975 and shows that they represent an increase of about 2% per annum for the 20 years from 1955. Over the period 1950/51 to 1956/57, the net annual increase in gas consumption throughout the whole industry was only .73%. The gas industry, therefore, is not taking its full share in meeting the increased energy demands of the country as a whole.

An analysis, however, of the gas consumption figures shows that any increase in consumption has been in the non-domestic field; over the period being considered this has in fact amounted to about 2¾%, which agrees with the general trend in increase of energy consumption as a whole. It would be fair to say, then, that in this particular section of consumption, gas is at least competitive in price with other fuels. It might be logical, therefore, to suppose that domestic consumption would react similarly if the price differential between gas for this and the non-domestic consumer could be eliminated by a reduction in costs of manufacture.

For the four boards in which this District Section is interested, this price differential varies between 4.15d. and 3.67d. per therm, and its elimination would mean a reduction in manufacturing costs of between 2.22d. and 2.81d. per therm. Since the average cost of gas production for these four boards, excluding capital costs, is about 10½d. a therm, a figure of 7¾d. a therm would have to be aimed at.

How is such a large decrease in costs going to be accomplished in the face of ever rising costs in labour and materials? Mr. Stott shows that there is only one way and that is to increase the size of manufacturing units and to work those units at the most economical load factor. Under present conditions conventional carbonising plant must be worked as base load plant and all fluctuations in demand met by gasification plant, either as total gasification of coal or from oil. In Mr. Stott's opinion, the modern works should contain an installed gas-making capacity of 50% base load plant and 50% gasification plant, representing load factors of 92% and 42% respectively. Such an arrangement should make it possible to reduce the net cost of raw materials to between 5d. and 5½d. per therm.

The other industries with which the gas industry is in competition, the oil and electricity industries, are both very much younger than the gas industry. They are

expanding at a truly enormous rate and are vital. The electricity industry has been able to concentrate its production into very large units since the war, and it is remarkable how technical progress in design both of steam-raising units and turbo-generators has enabled this industry to increase its efficiency and productivity. The increase in size of steam-raising units is clearly seen when installed boiler capacities are compared. At the end of March, 1949, there were 12 units producing 320,000 lb. of steam per hour or over, while at the end of March, 1957, there were 180 such units. At two modern stations to be opened shortly there are boilers of 830,000 and 1.9 mill. lb. of steam per hour. Generating plant has risen in capacity from a maximum of 60 MW. in 1948 to 275 MW. to be installed this year. Our sister industry, the coking industry, which has for some time thought in large units, has in the last two years brought large works into production at Avenue near Chesterfield and at Manvers Main near Doncaster, with throughputs of 2,175 tons and 3,000 tons of coal per day. The steel industry has also installed some large coking plants, but the object of building the two former works was to concentrate production from smaller obsolete coking plants, and in the case of Manvers Main to improve coal handling facilities by concentrating coal treatment from several collieries on the same site as the coke ovens.

Such very large units in the electricity industry are a problem which the gas industry has to face. Since nationalisation the building of large gas-making plants has been proceeding, but other problems, too, have to be solved, among which are the distribution of gas in larger quantities over longer distances. In Mr. Stott's view, if production costs are to be reduced by the amount he considers to be the minimum to hold and increase the domestic load, the capacity of the new plants should not be less than 60 mill. cu.ft. per day. These plants, if they are built outside the centres of large population, will make the development of bulk supply systems all the more necessary. Such an extension of the integrated grid systems should reduce even further the need for both bulk storage and standby plants to meet either breakdowns or peak loads. Under present conditions the maximum bulk storage needed is equal to about 12 hours consumption.

The use of complete gasification plant must be carefully considered since those using tonnage oxygen plants require to be of a certain minimum size before their use becomes economic. Mr. Stott points out that this minimum capacity would be not less than 40 mill. cu.ft. per day if the cost of gas production from them is going to be reduced to the low figure referred to earlier.

Anyone studying the bare statistics of the gas industry might be forgiven if he came to the conclusion that the gas industry was indeed stagnating. But this conclusion would be quite false since all those in any way connected with the industry are well aware of the immense strides that have been made since nationalisation in the better organisation of gas manufacture and distribution. In fact without all the thought and energy that has been poured into its development, the industry might well have suffered extinction. Mr. Stott rightly points out that in spite of the new thinking of which gas engineers have so clearly shown themselves capable, any old-fashioned or traditional notions must be ruthlessly discarded. The kind of thought inspiring modern industries such as electrical generation and oil production should be sedulously cultivated. With such ideas nothing should stand in the way of gas engineers being able to overcome all the technical problems confronting them in cheaper gas production and distribution.

If any confirmation of this view is needed, we would advise doubters to read once more Dr. Burns' Presidential Address to the Institution. In this he shows the industry's post-war accomplishments and outlines proposals for the large-scale production of gas in the most suitably placed areas, with which, we think, Mr. Stott would be in full agreement.

It Went Tick

A MAN walked into a Leeds shoe repairer's shop, bought a tin of boot polish, and put on the counter a heavy metal object with the request that the assistant 'give this to John.' He then walked out leaving a perplexed shoe repairer who, however, wrapped the object in newspaper and put it under the counter. When the object began to tick the shopkeeper became alarmed, phoned his boss, who came and examined the object. Seeing that it had 'a sort of time switch,' he took it to the police who promptly put it into a bucket of water and rang up the Army.

When a senior inspecting ordnance officer from Northern Command, York, came, he looked at the still dripping object and announced that it was a time clock for a gas lamp post.

The major from Northern Command took the clock back to York where, he said, 'We run a little museum of harmless objects we pick up from time to time. It could find a place there unless the gas people want it back.'

A Leeds Corporation Lighting Department official said the Army would have to write and ask the department to sell them the time switch if they wanted it for their museum: 'You can't give away Corporation property like that.'

Mr. Brewer Speaks

MR. F. G. BREWER, O.B.E., the Secretary of the Gas Council, is a familiar figure in the industry. In company with the Chairman or Deputy Chairman he is to be seen in all parts of the country attending gas board Staff Conferences and important events of all kinds. But apart from the few who have had the pleasure of conversing with him—including such people as the British Empire Medallists, who would no doubt testify to his charm of manner which helps to put them at their ease—it is doubtful whether many people have heard him speak. Indeed, due either to modesty or to a conviction that good secretaries are seen and not heard, Mr. Brewer has always given the impression of a backroom boy who has little taste for being brought to the front. It is somewhat ironical therefore to find that, with his retirement only a few months away, Mr. Brewer has suddenly blossomed forth as a public speaker. Those who heard his able reply to the toast of 'The Guests' at the I.G.E. London and Southern Section's lunch last week must agree that he has been hiding his light under the proverbial bushel. We hope to hear him again before he leaves the industry at the end of September.

Personal

DR. D. T. A. TOWNEND, C.B.E., Past President and Melchett Medallist of the Institute of Fuel, is to be one of the first recipients of the Gold Medal of the Institut Français des Combustibles et de l'Energie, a new foundation of the French Institute, designed to recognise outstanding scientific achievement in the field of utilisation of fuel and power. He will receive the award at a ceremony in Paris in the autumn.

J. R. W. ALEXANDER, Fellow of the Corporation of SS. Nicolas and Mary, has been re-elected Chairman of the Governors of Ardingly College which, on the occasion of its Centenary next month, will be visited by the Queen and the Duke of Edinburgh.

MR. H. ALLERTON, Engineer and Manager for the Llandudno undertaking of the Wales Gas Board, was re-elected Councillor in the recent Llandudno Council elections. In his second contest in two years he again topped the poll with a clear majority.

MR. W. D. CRANFIELD has been appointed Labour Officer at the Beckton works of the North Thames Gas Board; MR. D. M. PATERSON, Welfare Officer for Bromley, Bow Common, Stratford, Lea Bridge and Poplar works, and the stove department, Haggerston.

MR. A. J. C. FAGG has been appointed Home Sales Manager of the Merton Engineering Co., Ltd. Prior to this appointment Mr. Fagg was Sales Manager (Tractors) for Mackay Industrial Equipment, Ltd.

Scottish Western Junior Gas Association visited the works of James Stott & Co., Ltd., at Oldham, on May 9. Our photograph shows some of the party inspecting a sink unit. The party travelled over the Thursday night from Glasgow, visited Stotts' on the Friday, spent the Friday night in Manchester, visited Bolton Metal Products on the Saturday morning and travelled back to Glasgow overnight on Saturday, after having spent the remainder of the day at Blackpool.

MR. R. D. WATSON, Manager of the Lancashire District of British Oxygen Gases Ltd., has been elected Chairman of the Manchester and District Branch of the Institute of Welding for 1958-59.

MR. J. WATERHOUSE, Coke Sales Officer, Liverpool Group, North Western Gas Board, recently addressed the Liverpool Bakers' and Confectioners' Association.

MR. ERNEST HARMAN, Deputy Chairman of the East Midlands Gas Board, has married MISS ANNE PARSONS of Leicester.

MR. D. McC. BURNS is to retire from the Bangor (Co. Down) Borough Council's Gas Department after 46 years' service.

MR. F. HOLLAND, a chemist at the Vauxhall works of the South Eastern Gas Board, has retired after 50 years' service.

Obituary

MR. W. N. WESTLAKE, who was for many years Engineer and Manager of the Exeter Gas Light and Coke Company, died on May 28, aged 68. He retired from this post in 1937, being made a Director of the Company, a position which he held until nationalisation. He had served with the Exeter Gas Light and Coke Company for 50 years and had been Engineer and General Manager for about 25 years.

MR. T. R. COOK, who, until his retirement in 1951 was Gas Engineer and Manager at Blackpool, and previous to that held the same position at Rotherham, has died at the age of 66.

MR. THOMAS GOURLAY, former Gas Manager at Kirkwall, Orkney, has died.

Diary

June 5. — SOUTH WESTERN G.C.C.: Taunton. 11 a.m.

June 7.—EAST OF SCOTLAND JUNIORS: Golf Outing, Falkirk.

June 9-10.—I.G.E. EASTERN SECTION: Cromer. Annual General Meeting including Paper on 'The Control of a Grid Mains System.'

June 11. — COMBUSTION ENGINEERING ASSOCIATION: Grand Hotel, Charing Cross, Glasgow. Meeting including paper on 'A Comparison of Space Heating Systems,' by G. H. Buckle. 10.30 a.m.

June 11.—WESTERN JUNIORS: Visit to the works of Dowty Ltd., Cheltenham. 2.15 p.m.

June 12.—MIDLAND JUNIORS: Ladies' Day including visits to the Stroud works of George Waller & Son, Ltd., and the Severn Wild Fowl Trust at Slimbridge.

Calendar & Directory Alterations

The following changes have been notified recently. To keep the information in the current issue of the 'GAS JOURNAL' Calendar and Directory up to date readers are invited to note these alterations in the Directory Section.

D23.—THE GAS COUNCIL: Insert Brian Hill, *Assistant Publicity Manager.*

D24.—WALES: Major C. G. Traherne, *Chairman*, vice Sir G. F. Hamer, C.B.E., retired.

D27.—EAST MIDLANDS GAS BOARD: Insert Alderman C. M. Newton, M.B.E., and Councillor W. Albans, *Part Time Members.*

Page D28. — LOUGHBOROUGH: Delete S. A. J. Horrod, *M.*

Page D28.—LEICESTER AND NORTHANTS DIVISION: Insert S. A. J. Horrod, *Works Study Officer.*

D33.—SHEFFIELD AND ROTHERHAM DIVISION: G. Davies, *Divisional Sales and Service Manager*, vice W. J. Steed.

D33.—EASTERN GAS BOARD: Add E. O. Ross, *Chief Engineer;* D. B. Parkinson, M.B.E., Deputy Chief Engineer.

D38.—TOTTENHAM DIVISION: Delete D. W. Bunce, deceased.

D51.—MILL HILL: G. L. Braidwood vice P. G. S. Fry, *Station Engineer.*

D85. — TORQUAY/EXETER DIVISION: Delete J. W. Denton, deceased.

D89.—SOUTHERN GAS BOARD: Insert W. J. Steed, *Assistant Commercial Manager;* N. H. Greenway, M.B.E., *Industrial Development Engineer.*

D111.—SCOTTISH GAS BOARD: Insert Brigadier D. Russell Morgan, D.S.O., M.C., *Civil Defence Officer.*

D114. — CARDENDEN: Delete A. D. Coubrough, *M.*, resigned.

D117.—CUMNOCK: Delete H. Adams, *Dist. M.*

D117.—GLASGOW AND WESTERN DIVISION: Delete A. Jamieson, *Management Officer*, deceased.

D118.—MILLPORT: H. Adams, vice P. B. Stewart, *Dist. M.*

D118.—KIRKINTILLOCH: P. B. Stewart, vice J. Dickson, *Dist. M.*, retired.

D129.—COLOMBO GAS AND WATER CO., LTD.: T. G. Draper vice L. F. Nicholson, *G.E. & M.*, retired.

GAS GRID URGED FOR ULSTER

THE establishment of a gas grid for Northern Ireland was suggested at a recent meeting of the County Londonderry Employment and Training Advisory Committee in Coleraine.

As well as providing employment, it was felt that such a scheme would encourage small industries in outlying areas. The Committee decided to ask the Ministry of Commerce for its views.

Other news of gas in Ulster comes from Belfast, where it was alleged that the gasworks is in the hands of a ring for the supply of coal, by Alderman Robin Kinahan, M.P., in the Northern Ireland House of Commons.

Mr. Kinahan, who is a member of the Belfast Gas Committee, said that only six firms quoted for the supply of coal to the gasworks. 'We are tied hand and foot and cannot switch a ton from one firm to another,' he complained.

Lord Glentoran, Minister of Commerce, pointed out that anyone with knowledge of an agreement among two or more firms restricting competition could report the matter to the Registrar of Restrictive Practices.

Meanwhile, Newry Urban Council Gas Committee, which recently sought an investigation into the possibility of establishing a bog ore industry in Ulster has been officially informed that deposits of bog ore in the country are not sufficient to justify development.

A letter was read at a meeting of the Committee from Renick, Wilton & Dobson, of London, shippers of ore, oxide, and coal, which stated that they felt there were vast quantities of ore in Ireland. They were confident there was sufficient to supply the home market, and said that Irish ore was of the finest quality.

The Committee decided to forward copies of the letter to the Ministry of Commerce and the Northern Gas Board.

Bristol's Clean Air Plans

MORE than 200 acres in the centre of Bristol are to become a smoke control area if Mr. Henry Brooke, the Minister of Housing and Local Government, approves a provisional clean air plan now being submitted to him by the city health committee. The committee described the drawing up of this plan as a preliminary step towards implementing the terms of the Clean Air Act.

There are 1,405 buildings in the area, of which 281 are dwelling houses, 773 are commercial and public buildings, and 351 are factories and warehouses; 29 of the dwelling houses are likely to be included in slum clearance areas and 64 are alms houses.

Comparing magazines at the Annual Convention of the British Association of Industrial Editors are, left to right, Mr. F. E. Wiles, Editor of Southern Service *(Southern Gas Board); Mr. R. V. Townsend, Editor of* Link-Up *(North Western Gas Board), both of which received an Award of Excellence; Mr. E. H. Dodimead, Editor of* Thames Gas Magazine *(North Thames Gas Board), which gained a Certificate of Merit; and Mr. W. Kidman, Editor of the West Midlands Gas Board Magazine. Two other awards went to Mr. A. A. Clark, Editor of* E.G. News *(Eastern Gas Board) and Mr. J. Cawood, Editor of* Talking Shop *(East Midlands Gas Board).*

RATTLE SNAKE

ON emergency stand-by duty the other evening, Fitter Liddle, of the North Thames Gas Board, received the order, 'Release snake from water heater.'

Arriving at the Hampstead address, he found that Miss Julie Mendes, who stars in a dance act with Mogambo—a 6-ft. boa-constrictor—had given her partner a bath; and then left him to have a few minutes' splash around on his own. When she went back, she found Mogambo had gone. And a rattle had come inside the water heater!

Which was where Fitter Liddle came in. He dismantled the appliance . . . And stood respectfully aside while Miss Mendes lured Mogambo back into the bath.

New Natural Gas Well

Another well is being sunk by B.P. Exploration, on behalf of the Gas Council, in the latter's search for natural gas. This is at Noke, in Oxfordshire, where drilling commenced last week-end. The well will be comparatively shallow, about 1,000 ft., and should be completed in a fortnight.

Peat Gas for Eire?

Bord na Mona (the Irish Turf Board) is investigating the possibilities of producing town gas from milled peat. The Board has engaged an engineer with experience in the process and the principal Eire gas companies are co-operating.

CAPE ASBESTOS PROFITS REACH ALL-TIME PEAK

NET profit before tax of the Cape Asbestos Group of companies for the year ended December 31, 195[illegible] amounted to £1,421,021 compared with £1,154,595 for 1956, states the Group's annual report and accounts. This is the highest in the 64 years of the Company's history.

A final dividend of 12½% w[illegible] declared which, with the interim p[illegible]ment of 5%, makes a total distributio[illegible] to shareholders of 17½% against 15% 1956—a new peak.

Net profit of the Cape Asbestos C[illegible] Ltd., the Parent Company, was £801,774.

N.W. BOARD MAKES £·5 MILL. PROFIT

North Western Gas Board £500,000 in its ninth year, end[illegible] 31, 1958, Mr. D. P. Welma[illegible] Chairman, disclosed in [illegible] yesterday. This profit, arrive[illegible] all charges, represents a saving £1 mill. in the year by efficiency, and economies.

New S.W.G.B. Pla[illegible]t

It has now been decided th[illegible] hydrogenation plant which, as [illegible] our March 19 issue, is to be er[illegible] South Western Gas Board, w[illegible] in the Bristol area.

S.B.G.I. Officers and Council

SIR FREDERICK SCOPES has been elected President of the Society of British Gas Industries for 1958-59. Mr. S. N. Turner is Chairman, and Mr. W. D. King Vice-Chairman.

Chairmen of Sections have been elected as follows: Retort Settings, Mr. F. P. Dyson; Condensers, Washers and Purifying Plant, Mr. I. M. O. Hutchison; Mechanical Handling Plant, Mr. M. S. Gaskill; Gas Holders, Mr. J. S. Christie; Gas Meters, Mr. R. E. Mitchell; Gas Cooking and Space Heating Equipment, Mr. A. F. Oatley; Gas Lighting Equipment, Gas Fittings and Burners, Mr. C. H. Wilson; Manufacturers and Contractors for Gas Works not included in the foregoing and following, Mr. A. H. Collister; Industrial Gas Equipment, Mr. C. A. Lewis; Refractory Goods, Mr. D. C. Muir; Exhausters, Boosters and Compressors, Mr. G. Chambers; Chemical and By-Product Plant, Mr. S. B. Rippon; Water Gas and Producer Gas Plant, Mr. J. E. Tully; Gas Wash Boilers and Washing Machines, Mr. M. A. Griffith-Jones; Pipes, Tubes and Fittings, Mr. J. A. Wood; Gas Water Heaters, Mr. P. D. M. Aird; Scientific Instruments, Mr. J. Lubbock; Coke Ovens, Mr. J. Simpson.

Elective Members are Col. W. E. Gibbons, Mr. F. P. S. Stammers, and Mr. J. L. Walker; Ex Officio Members—Hon. Secretary, Mr. R. Knight; Hon. Treasurer, Mr. E. West.

SCOTTISH BOWLS ARRANGEMENTS

AT the annual bowling match between the Scottish Association of Gas Managers Bowling Club and the Scottish Gas Board, Dunfermline, Social Club, the Managers defeated the Board by eight shots.

The annual bowling competition of the Managers' Club will take place at Ayre on September 11, and on the previous evening it is proposed to hold a club dinner.

'Broadening of the Horizon' for the Gas Industry

MR. BREWER AT LONDON AND SOUTHERN LUNCH

'A GREAT broadening of the horizon for the industry' is one of the impressions Mr. F. C. Brewer, Secretary, Gas Council, has acquired, he told the Spring Meeting of the London and Southern Section, I.G.E., at lunch last week.

All around one saw new methods of approach to the problems, said Mr. Brewer, who retires at the end of September. Another impression he had was that the gas industry was always communicative of its ideas and ready to pass information on. The means of exchange of ideas and information was steadily increasing.

Mr. Brewer said he thought that engineers had an advantage over the people who were bringing new techniques to the industry, work study experts and the like, in that their methods of expression were more developed.

Dr. J. Burns, Immediate Past-President of the Institution, proposing the toast of the London and Southern Section, spoke of the Section's fame for its wealth of technical judgment and experience which it gave to the industry.

Imagination

What really made a professional body successful was what its members were prepared to put into it, and in this the Section had been led by the Chairman. Mr. Stott. 'In him you have had a really grand leader during the past year. He represents a combination of solidity coupled with foresightedness and a great degree of imagination.'

Mr. C. Stott (whose Chairman's Address we publish on p. 547) spoke of the success of the papers the London Section had given during the year. He had depended entirely on the engineering side thinking that at this time the industry depended on its new look in this respect.

Mr. J. C. Hogg, Senior Vice-Chairman, proposing the toast of the guests, welcomed Mr. E. J. C. Dixon, Controller of Gas Standards for the Ministry of Power. The Gas Council representatives were Sir Henry Jones, Deputy Chairman, and Mr. Brewer.

From the I.G.E. were present Dr. Burns and Dr. Braunholtz. He mentioned Mr. W. K. Hutchison, Chairman of the South Eastern Gas Board, Mr. C. H. Leach, Chairman of the Southern Board, and four Deputy-Chairmen.

Mr. Hogg welcomed Mr. J. E. Gray, President of the London Juniors, and Mr. J. D. Grant, the Honorary Secretary.

Hansard

He also welcomed the Technical Press, who were, he said, the 'Hansard' of their Section.

At the meeting Mr. Hogg was elected Chairman for the ensuing session. Mr. R. F. Robinson was elected Senior Vice-Chairman, and Mr. J. A. Hepworth Junior Vice-Chairman.

Merger Plans Agreed

Radiation Ltd., and Parnall (Yate) Ltd.

THE Directors of Radiation Ltd., and Parnall (Yate) Ltd., announce that 'It has been agreed that the proposed merger can best be effected by Radiation Ltd., making an offer for the acquisition of the issued capital of Parnall (Yate) Ltd. The offer will be on the basis of 12s. in cash and one fully paid Ordinary share of £1 in Radiation Ltd., for every two Ordinary stock units of 5s. each of Parnall.

'The existing Board of Radiation Ltd., will be increased by four Directors from the existing Board of Parnall. Of these four Directors, three are full time executive Directors, including Mr. F. P. S. Stammers, who will become Managing Director of Radiation Ltd., while retaining the similar position which he already holds with Parnall (Yate) Ltd. Mr. A. J. Parker will become a Vice-Chairman of Radiation Ltd.

... of nine Mexican chemical engineers—deans and heads of departments ... an universities—visited Birmingham recently as the guests of the West ... Gas Board. Members of a delegation which is spending several months in ... der a UNESCO scheme; they are pictured here on arrival at Swan Village works, with officials of the Board.

Nine Safe Drivers

At a ceremony in the Westborough showrooms of the North Eastern Gas Board, nine Board employees were presented with safe-driving awards by Mr. D. K. Blears, Assistant District Engineer. They were Mr. J. A. Mawman, Mr. J. W. Hargreaves, Mr. H. E. Banks, Mr. W. S. Chambers, Mr. A. Croft, Mr. S. H. Wilson, Mr. D. C. Walker, and Mr. H. A. Simpson. Mr. F. A. White, who had also earned an award, was absent owing to illness.

S.E.G.B. Complete Shipbuilding Programme

M.V. CAMBERWELL GOES DOWN SLIPS AT ABERDEEN

COMPLETING their shipbuilding programme, the South Eastern Gas Board's latest up-river collier, the m.v. Camberwell, was launched at Aberdeen on April 30.

The launching ceremony was carried out by Mrs. V. W. Stanton, wife of the Board's Commercial Manager. As the new ship took the water, she was greeted by the siren of another of the Board's new colliers, the m.v. Lambeth, which was in the harbour after satisfactory sea trials.

The Camberwell was built by Hall, Russell & Co., Ltd.

At a luncheon after the ceremony, Mr. R. H. Sandford Smith, the Board's Deputy Chairman said that during the past nine years, nine ships had been built for the Board in Scotland. It was a remarkable achievement to have the Camberwell ready to take the water within three months of the launching of the previous ship. All the latest ships had been fitted with British Polar engines and the accommodation and amenities provided for the crew were in accordance with the Board's policy as good shipowners.

Mr. Sandford Smith paid tribute to Captain Clarke, M.B.E., who is to command the Camberwell.

On the launching platform are, left to right, Mrs. V. W. Stanton, Mr. R. H. Sandford Smith, Deputy Chairman of the Board, and Mrs. Sandford Smith; Mr. V. W. Stanton, Commercial Manager of the Board; and Mr. John Wright, Managing Director, Hall, Russell & Co., Ltd.

Eastern Juniors Hold Annual General Meeting at Stamford

AT the annual general meeting of the Eastern Junior Gas Association at Stamford recently, the President, Mr. J. L. Ireland, was in the Chair supported by the Senior Vice President, Mr. W. F. Pritchard, the Junior Vice-President, Mr. W. J. Spiller, and the Hon. Secretary and Treasurer, Mr. V. A. Bignell.

Officers and Council appointed for the year 1958-59 were:—President, Mr. W. F. Pritchard; Senior Vice-President, Mr. W. J. Spiller; Junior Vice-President, Mr. D. G. Simpson; Hon. Secretary, Mr V. A. Bignell; Hon. Treasurer, Mr. J. S Hacon; Hon. Assistant and Transaction Secretary, Mr. E. S. Williams; Members of Council, Mr. W. M. Johnstone and Mr. R. L. Smith.

In addition, Mr. H. J. Blakeley and Mr. R. E. P. Hoskin continue to serve on the Council, while the Hon. Auditors, Mr. T. W. Benstead and Mr. S. Hall, were also reappointed.

After the President had given his annual report, the guest speaker, Mr. Dorian Williams, gave his address on 'Public Speaking.' Mr. D. G. Simpson proposed a vote of thanks.

The Chairman of the East Midlands Gas Board, Mr. R. S. Johnson, presided at the luncheon which followed. Mr. Pritchard proposed the toast, 'The East Midlands Gas Board,' to which the Chairman replied. Mr. Bernard Clarke, Divisional General Manager, Lincolnshire Division, proposed the toast, 'The Eastern Junior Gas Association,' and Mr. Clarke replied.

Among guests of the Association was Mr. Ault, Divisional Engineer Lincolnshire Division; Mr. J. Berridge, W. H. Allens, Sons & Co., Ltd.; Mr. G. Hudson, Group Manager Spalding/Stamford Group; Mr. Illingworth, Manager, Stamford. Past Presidents attending the meeting were Messrs. J. Marshall, E. H. Winch, J. Anderton, F. G. Cox, C. S. Dennis.

SOR-R-RY YOU'RE BEING TROUBLED

THE public has a right to know what goes on at the bottom of holes in the road, the East Midlands Gas Board thinks.

So, before they start to dig, Board workmen in Derbyshire erect large red and white notices which state, in 9-in. letters:

'Sorry for the inconvenience—we are improving your gas supply.'

AND NOW IT'S THE SOCIAL EVENT OF THE YEAR

THE annual show of a society formed nine years ago by two members of the staff of the Tyneside Division of the Northern Gas Board for the promotion of horticultural interests has now become the social event of the year. It attracts exhibits from all divisions of the Board.

Recently members of the society co-operated with the B.B.C. in the recording of the 336th session of the 'Gardeners' Question Time' programme, with the usual team of Freddie Grisewood, Professor Gemmell, Fred Loads, and Bill Sowerbutts. Questions ranging from the presence of clay pipe stems and willow pattern china in the soil, to the effect of temperature on the efficiency of insecticides were discussed.

The annual show this year will be on August 9.

For Works Managers

Ten meetings on maintenance management for works managers, plant engineers and others responsible for maintenance, have been arranged by the British Institute of Management, in collaboration with the Incorporated Plant Engineers. They will be held at fortnightly intervals at Management House, 80, Fetter Lane, E.C.4, the first meeting being on June 3.

Gas for the first time

With the completion of the gas grid from Elgin, gas production has ceased at the Buckie and Cullen works of the Scottish Gas Board. The new 22-mile link brings gas for the first time to the villages of Fochabers, Mosstodloch, and Lhanbryde.

SCOTTISH GAS BOARD'S SECOND STAFF CONFERENCE

Mr. Sydney Smith, Chairman of the Scottish Gas Board, opens the conference. Also in the picture are Mr. H. R. Hart and Mr. D. D. Melvin, Board Members, Sir Harold Smith, Chairman of the Gas Council, and Mr. A. Montgomery, Provost of Largs.

Vision for Scotland

IF the Scottish Gas Board's second staff conference, held at Largs on May 22 and 23 had to be summed up in one word, that word would be 'vision.' Throughout the emphasis was not so much on immediate problems as on the benefits to be obtained by long-term planning.

Mr. Sydney Smith, C.B.E., Chairman of the Board, opened the proceedings with a 55-minute, 7,000-word review of the year's activities. As a survey of the Scottish scene, it was all-embracing, even to the number of adjustments to the taps of old and infirm consumers (for the record, 150,142). Naturally, there were extensive references to the projected Lurgi plant in Fife (Britain's first-ever high - pressure complete - gasification plant, which is to produce 30 million cu.ft. of gas a day from poor-quality, non-caking coal) and to the replacement of the out-dated 24-tariff system by a single universal tariff.

A Small Surplus

He started with the heartening news that, on the financial results, in spite of increased expenditure, the Board would 'just about break even, and may even have a small surplus.' And he revealed that investigations are to start soon between Edinburgh and Glasgow, probably near Salsburgh, where there were indications that 'further worthwhile deposits' of natural gas might be found.

Continuing the good news: 'I am glad to report a slight increase in the sales of appliances—£1,455,400 as compared with £1,416,500 for the previous year; an increase of 2.7%.' But there was bad news, too: 'The number of cookers sold and hired was 13% less than the previous year; water-heaters sold and hired were down by 13%; and wash-boilers by 3%. These are by far the largest categories of appliances, and the continuing decline of sales and hires is a matter for grave concern. There has been some improvement in the sales of other appliances, however: Gas fires were up 19%; washing machines by 23%; refrigerators by 38%; and minor appliances by 15%. This is perhaps the start of a move in the right direction, but have still a long way to go before we even begin to arrest the general decline in the overall sales of appliances.'

The Chairman's Cup

Mr. Smith added: 'The position revealed by the sales figures is a challenge which can only be met by increased effort, and this will demand the highest standard of enthusiasm and determination from all staff concerned with sales. To encourage and develop the spirit of competition, a sales league has been formed in which selling units will compete with each other at both divisional and area level. I have personally presented a trophy, to be known as the Chairman's Cup, which will be awarded annually to the league leaders, and will be retained by them for 12 months.' (The handsome piece of silver adorned the platform table throughout the conference.)

Bulk buying of over 40 commodities, he revealed, had saved so far about £45,000 a year.

Leaving finance for first-aid, he reported a 'magnificent effort' which had taken the number of fully-qualified first-aiders in the Board's area to over 600.

Mr. Smith went on to state that the Board proposed, as an experiment, to staff 23 showrooms on Saturday afternoons. It was vital, he said, that every opportunity was taken to increase sales. These 23 showrooms were situated in busy shopping centres where other shops were normally open on Saturday afternoons, and it was felt that much potential business was being lost by keeping their premises closed.

On the whole, he summed up, the year had been one of substantial progress in many directions. But they were not yet clear of the danger of pricing themselves out of business by any means. This meant that if the industry was to expand it must undergo vast and swift changes. The Board's decision to build the plant was a clear indication that they were about to enter upon a new era.

Rosy Future

'What of the future? Believe me, given your continued backing, it is quite rosy. Our new organisation is rapidly settling down, and already benefits are beginning to flow. I have spoken of major developments planned and in hand. Together, we are ready to meet the challenge from whatever direction it may come. In spite of all the ballyhoo of nuclear power, the road ahead for us is not into the setting sun, but towards the new dawn: A new era of prosperity.'

From the factual record of the Chairman's report, the conference plunged into the mystical field of 'Operational

A pleasant ceremony at the end of the conference was the presentation by Sir Harold Smith (centre) of 40-year service awards to Mr. D. D. Melvin and Mr. Sydney Smith.

Research in the Gas Industry,' as expounded by Mr. H. R. Hart, Member of the Board, and Mr. H. A. Burns, Manager of the Organisation, Research, and Planning Department, Glasgow and Western Division.

Introducing the joint paper, Mr. Hart said that they had set out to define operational research and to give some instances of how it could be applied to the gas industry. An attempt had been made to show how the multi-discipline team approach helped to solve the many problems of top management. The method of attack was typically scientific —defining the problem, collecting and analysing data, drawing conclusions, and checking them against further tests. Examples were given to illustrate how these techniques could be applied to actual problems. It was clear that there was tremendous scope for the work of an operational research team in the gas industry, under modern enlightened management, and the main worry was not so much finding suitable problems to tackle, but deciding which problems should be given priority.

Composition of O.R. Team

The Glasgow O.R. team, he explained, consisted of the manager, who was a physicist with mechanical and chemical engineering background, an accountant, who had been in the industry for 33 years, an economist, a work study specialist, and two trained work study assistants.

Some of the major problems successfully dealt with included: A statistical analysis of the gas consumption in the Glasgow district (the facts deduced from this report formed a foundation for the introduction of a new tariff throughout the Scottish Gas Board); a report on Glasgow district chemical works (it is expected that the annual financial savings from this one project would be sufficient to pay the cost of several O.R. departments); a consumer service bureau; the functionalisation of gasfitting work; and numerous minor tasks.

'When it is considered,' Mr. Hart concluded, 'that these investigations required the co-operation of other staff, the arrangement of meetings, negotiations with Trade Unions, design of new forms, re-routing of document flow and the instruction of personnel in the new methods, it can be seen that the members of the O.R. team have been fully occupied. Indeed, on examining the short history of this very new department the question raised should not be, "Can we afford to have an Operational Research Department?' but rather, 'Can we afford not to have an Operational Research Department?"'

Some of these studies were explained in detail by Mr. Burns.

Airy Abstractions

The paper abounded in such airy abstractions as linear programming, the game and queueing theory, cybernetics, and symbolic logic, and was undoubtedly rather tough going for the conference—so much so that Mr. A. F. Pollock, the Board's Joint Chief Financial Officer, confessed himself 'a little bamboozled' by the mathematics. But, for the information which they put at his disposal and the savings they could achieve, he was prepared to wish more power to the elbows of the operational researchers.

As the accountant to the Board, he was involved in a constant battle to make ends meet. The industry in Scotland had many commitments. They were all desirable objects, but they all cost money. Short of putting up the price of gas, which was the last thing they wanted to do, the money could come from only one source, and that was from more efficient methods of working. That was where operational research came into its own. 'We already have in the area considerable experience of the results of work study and incentive schemes, and the results encourage the belief that a wider application of these methods will provide the economies necessary to enable us to do all the things we should like to do to enhance the reputation of the industry in the eyes of the public.' He was not very happy at the application of linear programming. No doubt it was an unexceptionable mathematical theory, but when it was applied to coal deliveries in the gas industry one had a few misgivings.

Shot in the Arm

This point was also developed by Mr. G. Ashwood, Headquarters, after he had commented that the discovery that there existed within the Board a team of experts employing these scientific aids to management would give a very useful shot in the arm to those who thought that scientific management was only to be found in brand new industries, and that the gas industry merely muddled along on accepted historical methods. In the gas industry, he went on, the problem of coal transportation was the most popular application for a linear programming routine, but was it the best example? Where linear programming had been most successful in other industries had been largely on production control. With coal transportation there were many external factors, affecting both quantities and costs, and a stoppage of any kind in a sector of coal production or transport would largely nullify the economies of the programme. That in itself might be a poor reason for discounting linear programming in this field, but when taken in conjunction with the effort involved in producing solutions, it might be realistic. The question appeared to arise: Should a production control exercise not be performed before a programme of coal supplies was undertaken? Only when optimum production had been devised, and the necessary quantities of raw materials been determined, could the coal transportation problem be solved to afford maximum economies.

No Place for Guesstimators

The paper's opening contention, he remarked, was that there was no room in industry to-day for the 'guesstimator' or the 'hunch player.' Probably all of them who had been involved in the production of statistics for management had met the type of executive whose only use for statistics was in the form of an appendix to support some preconceived project. According to him, if the statistics did not support the argument then they were either biased or out of date. They must agree that this type of hunch player was dangerous, and that there was, in fact, no place in industry for him. On the other hand, once the quantitative analysis of facts was made, how far could the operational research team go in directing executive action? Granted, the results of any analysis of two alternative procedures might point conclusively to one particular course of action, but this would not always be the case simply because there were factors in commercial

life which were not capable of accurate measurement. No doubt the answer in borderline cases would be to apply the theory of games and obtain the optimum return from an investment in both alternatives. But surely they must ask if another factor did not enter here—management as an entity in itself and not merely as an executive body giving authority to the conclusions drawn from quantitative measurement. They had heard of the industrial tycoon whose success was due to 'know-how' or to having his finger on the pulse of the market. These nebulous qualitative terms did not fit into a system of quantitative measurement.

Like Tommy Steele

Mr. W. Nicol Baird, Central Division, got himself involved in so many adjustments with the scientific aid to public speaking that he was later accused of hugging the microphone like Tommy Steele (he smilingly agreed there was room for a comparison—in that neither of them could sing).

Incidentally, he got in the best 'crack' of the conference. Remarking that Operation Research teams did some excellent work for the Army during the war, he recalled that one of their recommendations brought about the introduction of a punch-card system designed to produce the right men with the right background and qualifications for the right jobs. 'This system was requested to produce a driver blacksmith, and within a remarkably short space of time the request was met by the production of a nigger (no offence) who enjoyed the ubiquitous name of Smith. Need I add that with a name like that, it goes without saying that he was also a hell of a good driver! (Another member of the Clan Smith, seated at the platform table, thoroughly enjoyed that one.)

Mr. Baird, while remarking that it was heartening to learn of the operational research developments now already being applied to internal activities within the Glasgow Division, had a word of criticism. To his mind the O.R. team lacked balance. It could be improved upon by the addition of two individuals with gas engineering backgrounds—a specialist on production and one other representing service and sales, but both, if possible, with wide general knowledge of the activities of the gas industry. Without that essential background of gas engineering practice, he suggested, some rather astonishing results could be forthcoming. Moreover, while the authors referred to the protection of the team from the pressure of functional departments, he did feel that there was some need as well to protect the departments from the natural inquisitiveness of such a team.

Incentive schemes, he said, had undoubtedly proved a useful means of getting workers interested in increased productivity. Such schemes could, however, at times vary in inverse ratio to the efforts expended. He did not in any way wish to deprecate, for example, the use of incentive schemes for intermittent tasks such as purifier emptying. In such cases uncongenial work was got out of the way usefully and expeditiously. Was there, however, no other means by which they could gain the confidence and wholehearted support of all of their employees? He thought that would be forthcoming from their present increasing efforts in joint consultation, in improved communications, in generous training by educational and training schemes and with good discipline, but he also suggested that by continued Operational Research along the lines already launched by the authors they would be able to produce in time an organisation of such improved efficiency that by reducing costs of operation their tariffs could be reduced, or at least held during a period of inflation. They could then expect their business to expand and provide better paid and more congenial opportunities for all employees.

Commenting on one of the case studies he remarked that it was shown that in the circumstances investigated there was an overwhelming preference for an open fire. 'While it is true there are sentimental and other reasons for attachment to an open fire—for example, there is nothing better if you want to spit—the real fundamental preference, I believe, is based entirely upon economics, namely that coal and coke have always, in the past, been so much cheaper than any other fuel. Surely the popularity of paraffin heaters in recent times has not been derived from any other inherent preference than cheapness, nor is the development of all-electric housing schemes based on any other feeling than the mistaken one that it will save money to put in one service only. There are already signs of growing awareness that, with our new tariffs, the economic advantages of gas central heating is now within the means of many more consumers, or else why should they be turning over more than ever before to such installations at this time?'

Spittoon with Every Fire

All of which brought from Mr. Sydney Smith the comment: 'It has been suggested up here that we might consider providing a spittoon with every gas fire we sell.'

Mr. A. M. Donnet, N.U.G.M.W., came to the microphone bearing fragrant bouquets: To the Scottish Gas Board—'My Union has been making a study of standards of management and our conclusion is that the standards displayed by the Scottish Gas Board are rising fast to a very high level.' To Mr. H. R. Hart—'I know of no manager anywhere who is doing better in enlisting the willing and active participation of workers at all levels than Mr. Hart.'

He added that his Union was actively encouraging the members to give such co-operation, 'because it is satisfied that the Board's present programme is in the best interests of the workers, as well as of the country as a whole.' The only thing missing from the Glasgow O.R. team, he said, was an industrial medical psychologist—and Mr. Smith promptly gave the assurance that that would be seriously considered.

Mr. R. J. Howson, Glasgow, thought they should make a 'real go' of incentive bonus schemes within the industry; Mr. J. Reid, Edinburgh divisional work study officer, suggested an interchange of information at work study level to save different divisions going over the same ground.

The second day's proceedings started with a comment by Sir Harold Smith, Chairman of the Gas Council, on sales and service. The gas industry, he thought, had fallen below the level of the appliance manufacturers, and 'quite honestly, the level of the discussion at Harrowgate on sales and service was right back to the pre-war level. We have made no advance at all. I could not help thinking we have got to smarten up on the sales side. On the production side we have got a new industry entirely; on the sales side we are back at the level of the horizontal retorts, and the stopped-end, hand-fired horizontal retort at that!'

The answer was that they could not sell gas unless they gave a first-class service. Everybody in the industry, no matter what his job, must regard himself as a seller of gas.

Health, Safety, and Welfare

Following a talk on 'Leadership' by Admiral Sir Denis Boyd ('the most inspiring address I have ever listened to,' the Chairman called it), the conference turned to a consideration of the trinity of Health, Safety, and Welfare, as put forward by Dr. D. G. Waddell, the Board's Medical Officer; Mr. T. B. Livingstone, Divisional Production Engineer, Perth; and Mr. B. Preston, Divisional Personnel, Welfare, and Training Officer, Edinburgh.

Dr. Waddell stressed the interdependence and the unity of purpose of health, safety, and welfare. Human welfare, he said, could not be delegated to three departments of management and then forgotten about. To be vital, it must have the full co-operation and the active participation of all within the industry.

The prime medical aim was to maintain the employee in a state of positive health—to ensure that he was physically and mentally compatible with the job, both initially and subsequently throughout his working life; to ensure that his health did not suffer from his job or his working environment; to teach and to instruct him in the prevention of the known hazards; and in the event of accident, to ensure that treatment facilities were readily available.

The crux of the matter was that no worker entered an industry as new plant—he was already second-hand. The haphazard engagement of employees created the grave problem of misfits. But where the prospective employee's physical and mental fitness was measured against the known job demands, the misfit disappeared. To minimise the frequency of misfits, medical questionnaires were being increasingly used when it was not possible to have a pre-employment medical examination.

Health and physical capacity were not static, and a periodic medical check-up

scheme was required. It was essential for the working environment and the 'employee services' to be constantly ship-shape, and for all jobs to be under repeated hazard review. The recognition of any insidious effects from the job posed further problems, for these effects were not immediately self evident. The time lag could be reduced by a suitable sickness/accident recording system. Such a system can prove or disprove the health of a particular industrial group or of the industry as a whole. It also projects the accident picture. Guess-work disappears.

'Despite the display of scores of precautionary notices on CO poisoning, its treatment,' Dr. Waddell added, 'I have been profoundly disturbed by the outdated and sometimes dangerous methods of treatment employed, and by the almost non-existent practical knowledge of artificial respiration. I am happy to say that in the past 2½ years, there have been radical changes in this grim picture. Now, around 50% of employees are conversant with and practised in the correct treatment of minor gassing cases and in artificial respiration. Minor gassing incidents are far, far too common. In most cases they spring from failure to use the fresh air breathing mask. The contention that acclimatisation or the ability to "stand more gas" can be developed with repeated exposure is completely untenable—it is a physiological impossibility.'

Accidents Can Be Prevented

Mr. Livingstone started off with the uncompromising statement that all accidents could be prevented—but the problem was to find the means of prevention. That problem belonged to management at all levels, which must bear the responsibility for the present accident frequency rate. He welcomed the lead recently given from Scottish Board Headquarters in the request for details of accidents; the more publicity that was given to individual incidents, their cause, effect, and means adopted to prevent recurrence, the more likely it was that the accident frequency rate would be reduced. But publicity in itself was only a means to an end.

To issue instructions was not enough; it was essential to ensure that they were carried out. There must be discipline to ensure that work was carried out in an orderly and controlled manner, with the safe execution of the work receiving due attention. That was the responsibility of the foreman and his immediate seniors. They must be armed with the necessary knowledge, and the means of applying their knowledge. That was the responsibility of the management.

To attain this standard, and better it, it would be necessary to hammer home the subject of 'safety' at every opportunity. 'If any of you here feel in agreement with my suggestion that a trophy might be provided for competition between the four divisions of the Scottish Gas Board, for achievement in accident prevention, please do so publicly.'

Mr. Preston took over the rôle of introducing to the conference the Divisional Personel, Welfare, and Training Officer, who is something of a newcomer to the industry in Scotland. He went on to ask: 'Do employees really want social welfare clubs at work nowadays and if so, why do existing ones receive so little support?' (Only 5½% of the 900 members of the Edinburgh club, he said, use the club each month.)

The main factors militating against the formation of flourishing social clubs seemed to be the divergent interests of the employees themselves; the existence of a great number of clubs and facilities outside the work place; the fact that many employees liked to get away from everything which reminded them of their working environment; and the fact that many young people, the chief supporters of the clubs, married and left the clubs. Nevertheless, there was obviously much to be said for employees getting together on social occasions and getting to know each other better.

Authoritative Textbook

Opening the discussion, Mr. R. H. Foston, Perth, said that a real step forward in first-aid training would be made by the publication of an up-to-date and authoritative textbook, which would perhaps include some industrial matters. Accidents, he remarked, did not always happen in the most convenient situations, and it would be a distinct advantage if first-aid teams could undergo training in the Civil Defence technique of rescue. The provision of rescue tackle where it did not exist would also be an advantage.

Mr. C. C. Drury, N.A.L.G.O., complained that it was not sufficiently recognised that many of the factors to be considered in the assessments of jobs and working conditions were just as important to the productivity of clerical and administrative staff at all levels as they were to manual and technical. The stress and strain of working in noisy, draughty, poorly-ventilated, or ill-lit offices could have a serious effect. Large-scale organisation arising from nationalisation had produced centralisation of administrative and accounting functions, etc., to a degree which had necessitated bigger and better premises for the main administrative units of these organisations, but, with a restriction on capital expenditure and more pressing demands for its use in new technical development and plant, it was inevitable that conditions in the office might not be all that was desirable. His Association regretted that Dr. Waddell was not able to include in his references to statutory obligations the implementation of the recommendations of the Gower Report. He hoped the Board and Dr. Waddell would have regard to these recommendations wherever possible.

Enthusiastic backing for an inter-divisional accident prevention competition came from Mr. J. D. Campbell, Falkirk. Miss J. Farquharson, Glasgow, asked (and received an immediate assurance) about the possibilities of a first-aid training class for home service advisors after working hours. Mr. G. J. B. Cox, Edinburgh, felt that a great many designs of gasworks plant left something to be desired in the matter of ventilation. He added that Granton was experiencing an alarming increase in the proportion of accidents caused by faulty methods of lifting—strained backs and slipped discs. Was a demonstration team to show the correct method of handling materials worth considering?

Quoting the safety rule that 'a clean factory means fewer accidents,' Mr. H. S. Milne, Aberdeen, recalled that in pre-war years Scottish gasworks had a well-deserved reputation for cleanliness, but there had been undoubtedly a general deterioration in this direction. There was no doubt that a return to former standards would not only assist in the promotion of safety, but would promote overall efficiency and economy.

Bikinis—Message Got Home

A poster which used two little ladies in bikinis to illustrate artificial respiration procedure, was recalled by Mr. A. Jackson, Dumbarton. That message certainly got home, he said. Their approach by poster to accident prevention should avoid the technique of using a list of 'don'ts.'

Mr. J. R. Joslin, Glasgow, said that any service to employees should be provided only where desired, be mutually beneficial, and be administered so far as practicable by the employees themselves.

Dr. Waddell replied briefly: A new first-aid textbook, the work of all three first-aid organisations, would shortly come on the market, correcting many of the divergencies in treatment; the suggestion that first-aid should be combined with a Civil Defence background was a good one; so was Mr. Cox's point on ventilation; there were some good films on the correct methods and dynamics of lifting, which could be made available; accident proneness could to some extent be revealed by a proper accident recording system.

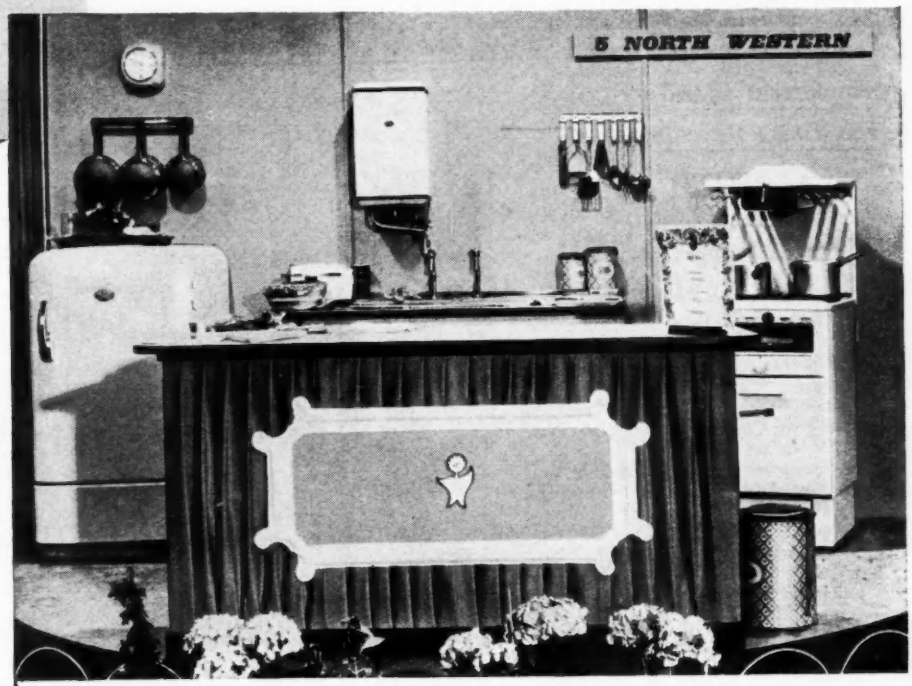
The final session of the conference featured a large-scale address on 'Management Problems in Large-scale Organisations,' by Professor T. E. Chester, Department of Social Administration, University of Manchester.

Mr. Nicol Baird's second appearance at the microphone to take part in the discussion was highlighted by his use of a Biblical illustration. Mr. Donnet, also paying a return visit, begged leave to withdraw the Tommy Steele parallel: he would, he said, substitute Billy Graham.

Sir Harold Smith wound up the discussion with an analysis of their own large-scale organisation—the nationalised gas industry. He recalled how the structure had come into being, and the many tasks that were carried out by the Gas Council. What of the future? Today each area board was responsible for its own production of gas, but in 10 or 15 years' time the way things were developing it might well be that production would have been centralised. He was quite sure that when the time came for production to be centralised more than it was today there would be no difficulty in the Gas Council arriving at the proper decision.

Congratulations!

to the
NORTH WESTERN GAS BOARD
and to their Area Finalist **ROY WILKINSON**
of Gorse Hill Hotel, Stretford, Lancs.,
on winning the
NATIONAL YOUTH COOKERY COMPETITION
sponsored by the Gas Council.



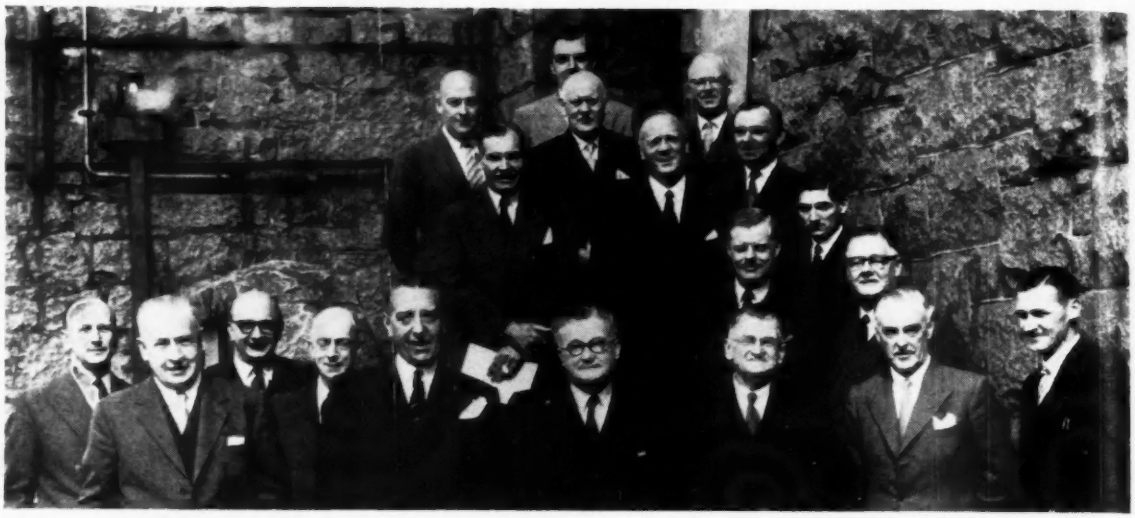
The appliances Roy Wilkinson used in the National Final were all winners too!

- Main Super-Century Cooker
- Main Thermain No. 2 sink water heater
- Main No. 36 Refrigerator

R. & A. MAIN LTD., GOTHIC WORKS, LONDON and FALKIRK
MAIN WATER HEATERS LTD., GOTHIC WORKS, CROYDON, SURREY.

Note the name-made by MAIN

S.W. Tar Distillers See Jersey Sulphur Removal Plant



After the presentation of a paper on sulphur removal by Mr. W. Wedgwood, Engineer and Assistant Manager of the Jersey Gas Light Company, at the I.G.E. meeting in London, 22 members of the South Western Tar Distilleries Committee were shown over the modern purification plant at the Jersey works. The committee is composed of members of the Southern Gas Board, the South Western Gas Board, and the Channel Islands Gas Companies. In our photograph, Mr. S. W. Pepin, Managing Director, is third from left in the front row and Mr. W. Wedgwood, second from the right.

Supplement Issued by *The Times* Reveals—

A BRIGHT FUTURE FOR GAS

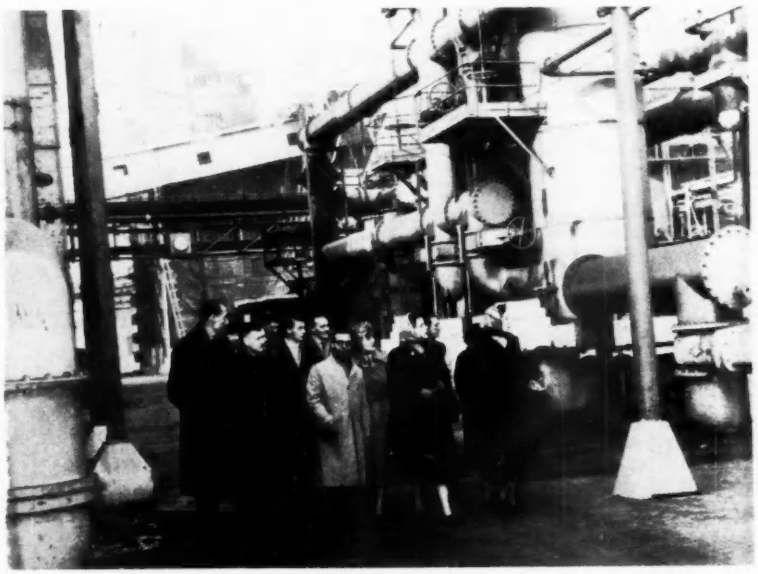
A TWELVE-PAGE supplement on 'The Future of Gas' was issued with *The Times* on June 2. Admirably illustrated, it contained articles by many prominent members of the industry including the Chairman of the Gas Council, Sir Harold Smith.

'A few years ago the gas industry was commonly regarded as an industry on the way out, whose markets would be progressively eroded,' writes *The Times* in an editorial in the supplement. 'Now it is recognised as a centre of vigorous activity and innovation, with an expanding future,' the editorial continues.

'This healthy change is due to technical advances, new raw materials, fresh energy in finding markets, and zeal for co-ordination to make the full use of new methods without losing the advantages of flexible decentralisation . . . .'

The articles cover a very wide field; of them, *The Times* concludes its editorial with the comment: 'The picture that emerges . . . is thus one of a vigorous and enterprising industry at the beginning of a new stage of its development, facing a new challenge, but presented with great opportunities.'

For the gas industry this supplement made excellent publicity. For *The Times* readership it provided a wealth of interesting information about an essential service which is taken generally for granted.



Getting to know the other man's job had a practical outcome the other week when a party from the Central Division of the North Thames Gas Board, some of whom are pictured above, made a visit to the Nine Elms gasworks to see how the gas they sell is made. The idea began as a suggestion put forward at the Divisional Joint Staff Consultative Committee, and about 100 employees, with their wives and families, including Mr. C. Pearson, Divisional Manager, and Mr. J. A. D. Hutton, his Commercial Assistant, were welcomed to the works by Mr. T. Bispham, Deputy Station Engineer.

Powell Duffryn Ltd.

Powell Duffryn Ltd., have declared a dividend of 2½% actual, less tax at 8s. 6d. in the £, on the 3.6 mill. 4½% Cumulative preference shares of 10s. each for the six months ending June 30, 1958.

£55,000 Paid

Stockton Corporation has paid over from its municipal superannuation fund £55,593 to the Gas Board's superannuation fund in respect of former employees transferred from the corporation gas undertaking.

From the Chairman's address to the London and Southern Section, I.G.E., May 27.

The Integration of Gas Manufacture

By C. STOTT, M.C., B.Sc., A.M.I.C.E., M.I.Chem.E., M.Inst.Gas E.,
DEPUTY CHIEF ENGINEER, SOUTH EASTERN GAS BOARD.

BEFORE considering the principles underlying integration of manufacture it is pertinent to assess the future prospects of the industry. As suppliers of energy largely in the form of heat it is to be expected that these prospects would be closely related to the National energy requirements. Throughout the world there is a determination to raise the standards of living and this has led inevitably to a large increase in the demand for energy. Since 1932 the world demand has practically doubled. This movement continues and forward estimates envisage the increase continuing at an annual rate of about 3%.

A recent estimate[1] made for Britain's Fuel and Power Budget, in terms of coal equivalent shows that the inland demand for energy, as coal equivalent; at 250 mill. tons in 1955, 300 mill. tons in 1965, rising to 360 mill. tons in 1975, reports an annual increase of 2%.

Ominous Implication

It would appear then that the gas industry could expect this increase of 2% as a bare minimum, for no credit is taken for the possible partial replacement of coal and coke by gaseous fuel. This expectation is not, in fact, being realised, for since vesting the gas industry has increased its production by only 0.73% per annum. The four area boards in which this Section of the Institution is directly interested had an annual increase over the same period of: Eastern, 1.53%; North Thames, 1.08%; Southern, 0.28%; South Eastern, 0.37%. This carries an ominous implication of stagnation which normally would stifle development and progress.

The indication of a different picture begins to emerge when the figures for gas output are broadly divided into domestic and non-domestic sales. An analysis is given in Table 1.

TABLE 1
ANALYSIS OF GAS SALES

	Eastern	North Thames	Southern	South Eastern	Gas Council
% Annual increase (+) or decrease (−) in gas sold 1950/51-1956/57					
Domestic load	0·00	−0·38	−0·65	−0·62	−0·75
Non-domestic load	+4·42	+3·37	+2·65	+2·76	+2·78
Total	+1·53	+1·08	+0·28	+0·37	+0·73
1956/57					
% Domestic load	60·3	55·8	67·6	67·0	53·0
% Non-domestic load.. ..	39·7	44·2	32·4	33·0	47·0
1956/57 Average revenue pence per therm					
Domestic	23·97	22·77	24·42	22·35	22·34
Non-domestic	20·02	18·81	20·27	18·68	15·96
Total	22·40	21·03	23·08	21·14	19·32

Although the ratio of domestic to non-domestic gas varies over the country, it is clear that the same story is told. Domestic demand is declining but non-domestic sales show an increase, and this is true for all 12 area boards. The extent of this increase is in broad agreement with the expected rise in the national demand for energy. It would be fair to conclude that in this field at least, gas can compete successfully with other forms of energy, and that price is the deciding factor.

The price differential between domestic and non-domestic gas is of significant interest and the figures are: Eastern, 3.95d.; North Thames, 3.96d.; Southern, 4.15d.; South Eastern, 3.67d.

Although it may be argued that domestic demand may not react to price in the same way, a logical objective would be to reduce the cost of manufacture so that gas could be offered to domestic consumers at the price at which its competitive power in the non-domestic field has been proved. This would involve a reduction of the present manufacturing costs per therm for the boards of: Eastern, 2.38d.; North Thames, 2.22d.; Southern, 2.81d.; and South Eastern, 2.46d.; assuming that the differential was eliminated through manufacturing economies only. Having defined an objective the possibility of its achievement can now be considered. The average approximate cost of gas manufacture, excluding capital, for this part of the country is given in Table 2.

TABLE 2

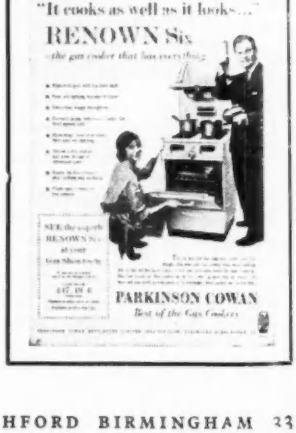
Net process materials	6½d.
Process	1½d.
R & M	1d.
Works overheads	1½d.
Total	10½d.

Here again, the average condition obscures the real facts. There are works within our knowledge which do very much better than this, and others decidedly worse. It would be true to say that the gas industry, as traditionally organised, could not approach even this figure; and it is abundantly clear that the age when gas was manufactured in every centre of population is very definitely past. We are in a very different era where every possible advantage should be taken of locality, new methods and ideas.

Carbonisation in the South of England should be conducted at sites suited to receive seaborne coal. The works should be big enough to take up the unloading capacity of the jetty. Carbonisation should be in bulk, with the maximum possible load given to this form of plant and its ancillaries. In actual fact, full economy is only realised in the carbonising process when the plant is on base load, all requirements above that load should be met with gasification plant. Working to a declared c.v. of 500 B.t.u. per cu.ft. and meeting the diversity of load exerienced in this part of the country, works of this type would have carbonising and gasification plant of equal installed capacities, the annual make would be coal gas 69% and gasification gas 31%, giving the respective plant load factors of 92% and 42%. Similarly, oil gasification and complete gasification of coal should be carried out at sites favourably located to receive raw materials on the large scale. Under such conditions the net cost of raw materials can be reduced to between 5d. and 5½d. per therm. Location and size are the overriding factors in modern industrial practice, and this concentration of plant is very evident in other industries. Manufacture on the major scale makes possible the use of large units of plant, with attendant reductions in capital costs, process and maintenance charges per unit of production.

The oil refining capacity in the U.K. of 31 mill. metric tons per annum is located in 15 refineries, of which eight are responsible for 97% of the throughput. This sharply contrasts with the technique of our own industry where 27.6 mill. tons of coal per annum are carbonised in 611 works. This gives rise to a startling difference in productivity, for 1 mill. tons of crude oil per annum is dealt with at a refinery by 500 persons, while for 1 mill. tons of coal per year processed in the gas industry the employment of 2,070 persons at works is required. These figures are not necessarily discouraging for they contrast an industry developed at a great pace in modern times with our own at the point where the impact of new ideas is breaking the traditional pattern of manufacture. The new methods now being fostered by the gas industry are quite capable of closing this divergence in productivity. The size of the items of plant installed in the refineries is in accord with this scale of opera-

They will get to know us and the RENOWN Six



These advertisements will bring them to your showrooms

They will have seen it on television, they will see it in the national magazines and the press — make sure they see the Renown Six displayed in your showrooms. Housewives' preference for the Renown Six has been proved by considerable research in all parts of the country.

★ Above all they like the high-level grill—for visibility, quick cooking and for its size.

★ Self-lighting hotplate burners come high on the list.

★ They are in favour of the very large oven and like the chromium-plated safety shelves and fittings.

★ From the many other popular features of the Renown Six, the Ajusto with its low setting device was the housewives' choice.

★ They certainly like its looks, coloured taps and the flush wall fitting which the forward oven vent permits.

IMPORTANT NOTE: Husbands think the price should have special mention. At £47.19.6 this is the best value in high grade cookers. They and their wives together voted heavily for the Renown's easy-clean styling.

PARKINSON COWAN

Best of the Gas Cookers

PARKINSON COWAN APPLIANCES LIMITED (GAS DIVISION) STECHFORD BIRMINGHAM 33

FGA GC13A

tion. For example, the Kent refinery power station is of 16 MW. capacity in two 5,000 kW. and two 3,000 kW. generators, and the boiler battery of five boilers raises 750,000 lb. of steam per hour at 560 lb. per sq. in. gauge and 740°F. The cooling water requirement for the refinery is 4 mill. gal. per hour. Four pumps of 1½ mill. gal. per hour each, draw the water from the Medway; the pump pressure is adequate to supply the user, with sufficient residual pressure to pass the effluent to the outfall. They are the only cooling water pumps on the refinery. The power arrangements at Coryton are on the same major scale. Steam is raised in three boilers each rated at 180,000 lb. per hour, and there are three generators each of 4,000 kW.

In the coking industry recent developments strongly reflect the same policy. The Avenue plant of the National Coal Board carbonises 2,175 tons of coal per day in two batteries each of 53 ovens. Provision is made in the layout and general planning for 100% expansion. The by-product plant deals with products from 4,500 tons of coal feeding from its own coking plant and others in the district. Steam is raised at 475 lb. per sq. in. gauge at 640°F. in three boilers, each raising 60,000 lb. per hour. Power is generated in two turbo alternators each of 5,000 kW. passing out at 120 lb. per sq. in. gauge. The Dorman Long South Bank plant of 150 ovens carbonises 3,600 tons of coal per day and the layout allows for a complete duplication. The Steel Company of Wales Ltd. has 234 coke ovens at its Abbey works and the steam raising plant consists of four boilers each rated at 87,200 lb. per hour at 630 lb. per sq. in. gauge and 820°F. At Manvers Main 137 ovens carbonise 3,000 tons of coal per day. Steam, raised in three boilers each rated at 60,000 lb. per hour, is passed at 625 lb. per sq. in. gauge and 815°F. to two back pressure turbo alternators exhausting at 160 lb. per sq. in. gauge and generating 3,500 kW. This plant at Manvers is the replacement of six separate coking plants by one modern plant on one site.

Progressive Development

In the generation of power the policy of the Central Electricity Authority affords an impressive example of major scale planning. Tables given in the paper indicate the pronounced move to the large unit sizes, and the effect of this move to major scale working in the manpower comparison. The effect as a cost per unit is also shown.

The rise in fuel cost of .1441d. per unit between 1948/49 and 1956/57 accounts for 95% of the total rise of .1518d. between these two dates.

Apart from the reduction in capital cost the large unit gives economies in manning and in maintenance. This is confirmed in that process labour has risen by only 21% over the eight years period and the maintenance figure actually held, despite a rise in cost indices over the period of 74%. The maintenance figure, however, carries the advantage of the considerable installations of new plant over the period. The policy continues to be applied with intensity and the C.E.A. in 1957 installed 34 turbo generators having an aggregate installed capacity of 1,893 MW.; new boiler plant comprised 41 boilers of 15.95 mill. lb. per hour aggregate capacity, boilers each raising 830,000 lb. per hour were included in this total. Ten years ago the largest boiler installed in this country was 365,000 lb. per hour capacity. This progressive development is being continued as the declared policy of the newly formed Central Electricity Generating Board to reduce generating costs by increasing the capacity and efficiency of boilers and turbo alternators.

At Castle Donnington six 100 MW. generators will be served by six 830,000 lb. per hour boilers. At Blythe 'B' in Northumberland, two 275 MW. generating sets have been ordered together with two boilers each raising 1.9 mill. lb. per hour at 2,400 lb. per sq. in. gauge and 1,055°F. These pronounced elevations of pressure and superheat are but a further manifestation of increased capacity. The overall efficiency of this installation is designed at 35%. At Thorpe Marsh 550 MW. sets are to be installed; they will be twin shaft cross compound units, each of 275 MW. Two of these double sets are proposed, each supplied by a boiler evaporating 3.75 mill. lb. per hour at 2,400 lb. per sq. in. gauge and 1,055°F. This single boiler rating exceeds the total capacity of any of the existing stations of the C.E.G.B. The enormous strides made in the development of generating plant since the war is quite startling. In 1948 the maximum size of generator was 60 MW., in 1958 this had grown to 275MW. The limit is being reached, oddly enough, not through engineering considerations but because the stator weight of 150 tons represents the maximum load that can be put on road.

The saving in capital cost including that of the relatively reduced size of buildings is such that the total costs are nearly down to the 1948 figure of £50 per kW. installed. This means that the rising cost of engineering works of 74% since 1948 has been practically offset—a tremendous achievement. Apart from the reasons discussed, the Electricity Authority find a technical advantage in the large machines. As the size of a generator increases, its output increases at a greater rate than its losses, and becomes a more efficient machine; also, as turbine size increases the flow characteristics improve. This emphasis on efficiency can be better understood when it is realised that an improvement of 0.5% in the performance for the Authority represents a coal economy of 1 mill. tons per annum. Further examples of these trends could be quoted from the steel, chemical and other industries. It is very evident that modern industry is 'moving in a climate of thought that is vigorous, expansive and urgent,'[2] and the time has certainly come when our own industry must ruthlessly discard outworn and obsolete methods and ideas.

Major scale manufacture can have an effect on the gas industry, as well, but the provision of capital for new plant in a static industry is more difficult in that it must be largely for replacement, and in addition to the charges on the new capital the unexpired value of discarded plant has to be written off.

Capital Costs

The advantage of new plant in the reduction of operational and maintenance charges should not be offset by inflated capital charges and a limit of say 3d. per therm *made* can be taken as a reasonable objective. This expression of capital charge per therm *made* requires definition, and here it refers to the cost of a complete new works working on a load factor of 67%. This represents a capital expenditure of £43.6 per therm of installed capacity. As shown in other industries, the policy of establishing major works employing large units of plant carries direct economies in capital cost, process, supervision and maintenance. For any given type of plant, capital expenditure per unit of output shows a progressive reduction as the size is increased. This change in basic cost follows in general the expression —cost varies as (capacity)^x. For items of plant involving vessels and machines of the same type but of different size, the value of x is $\frac{2}{3}$. Actual examples of these variations of cost with size are given for typical plant items in the gas industry.

Tables were given in the address showing the reduction in capital cost of steam raising in oil fired boilers rather than breeze fired boilers. For example, a boiler of capacity of 80,000 lb. steam per hour, fired by oil, can raise steam at 500 lb. per sq. in gauge and 750°F. at a capital cost per ton of steam per hour of £5,110 compared to a similar breeze fired boiler at £12,330.

Three important lessons can be drawn from these tables of steam plant costs:—

(a) Consider a major works with an installed steam raising capacity of 160,000 lb. per hour raised in two 80,000 lb. per hour breeze fired boilers. Comparing this with a dispersal in four small works each carrying two 20,000 lb. per hour boilers, the saving in capital is nearly £300,000. This is a 25% capital reduction; maintenance charges would fall by about this figure, while the cost of attendance would be at least halved.

(b) Where the steam and power balance of a works encourages steam raising at high pressure with power generation in turbine plant passing out to the works for process use, the additional capital cost of the high pressure boilers is not significant.

(c) The 60% reduction in capital cost on oil fired boilers is due to elimination of conveyors, feed and grate arrangements, ash removal, structural work and buildings. Again, process, attendance and maintenance could reasonably be expected to fall in roughly the same proportion. Where the site and process favour its use this method of steam raising has an outstanding advantage.

The cost of construction of gas holders per mill. cu.ft. storage falls sharply with increasing size. Thus the cost per mill. cu.ft. for a 1 mill. cu.ft. holder at £125,000 is reduced to £90,000 for a 5 mill. cu.ft. holder. In many areas planning permission restricts the height of holders. This limitation can

be largely offset by constructing the tank below ground. This procedure involves an interesting study in methods of construction in order that the additional storage capacity may be obtained with the maximum economy.

In view of the pronounced attraction of gasification processes at high pressure in the presence of steam utilising the heat from partial combustion with oxygen, capital costs of tonnage oxygen plants are of increasing interest. Due to their hitherto limited use, costs are not easy to obtain, but the figures given by D. N. Gwyther[3] in a recent paper indicate the relative cost of plants of differing capacity. Such figures confirm the opinion that high pressure gasification cannot be applied to any but large scale projects if manufacturing costs are to be reduced to the level required. Thus 1 mill. cu.ft. of 400 B.t.u. gas produced by the high pressure gasification of coal requires 8 tons of oxygen; the same volume of hydrogen produced by the high pressure gasification of oil requires 10 tons. Again, the same general theme of this discussion emerges, the full economy of these new methods can only be obtained if they are installed on an adequate scale, and it seems quite clear that the minimum capacity of these plants should be not less than 40 mill. cu.ft. per day. On this view the initial installation of Lurgi plant at Dorsten at 45 mill. cu.ft. per day is significant.

A further factor affecting capital expenditure on major development is that such projects are normally carried out in stages, and it is important that the size and time sequence of these stages should be carefully planned in order to make the best use of capital. The post-war development of coke oven and c.w.g. plant at East Greenwich provides an interesting example of this problem. As can be readily understood, the capital cost per unit of capacity falls with succeeding extensions of plant, for all stages except the final one carry an element of forward expenditure in respect of those following; this is particularly true of the first stage which should, where possible, represent half the total development. This reduction of cost at completion is also due to the inherent economy in building large blocks of plant. In the case of coke ovens, a capacity of 2,000 tons of coal per day represents the minimum size of plant if full capital economy is to be obtained.

Obligation of Supply

Capital expenditure is obviously affected by the level of plant capacity installed to meet the demand. The gas industry carries an obligation of continuity of supply, and to meet climatic peak loads there is a strong temptation to play for safety and carry a substantial reserve capacity; this can result in an outlay of idle capital. In approaching this question the easy, but entirely unacceptable answer, is to provide manufacturing plant of a capacity equal to the estimated demand on the maximum day. Holder capacity is an important factor in this consideration, and Burns and Clark[1] have shown that this should be equal to 47% of the maximum day's demand. This figure has been confirmed by experience in S.E. England generally, and 12 hours storage can be taken as adequate cover. Assuming that the holder storage meets this requirement, a manufacturing plant capacity could be accepted equal to the average day of the demand during the maximum week. The additional plant necessary to meet the maximum day as contrasted with the average day of the maximum week would be about 7% in this part of the country, and would involve an increase in the cost of all manufacture of ½d. per therm equally split between capital and operational charges. Any reduction in plant installed represents an economy in capital expenditure, but it is also true to say that process labour, maintenance and overheads are a closer function of the capacity of plant installed than of the amount of gas produced. A too lavish safeguard of continuity is only gained at the expense of competitive power.

There are very few days in the year when plant is really tested, and it is fundamental that the maintenance should be at such a standard that the call is met. This aspect is a separate study and concentration of manufacture on the major scale brings the problem of reconciling the use of large units and items of plant with the demands of maintenance and continuity of operation. R. F. D. Reed[5] in an admirable paper to this Section of the Institution earlier this session presented the principles of this class of maintenance and their application to refinery practice where the standards of continuity are almost as rigid as our own. The nominal rating of plant is seldom the point of maximum capacity and with maintenance at the requisite level, plant should be capable of a reserve capacity of some 10% for a limited period. The relation between plant capacity and its actual annual output is, of course, expressed in the load factor and for works established and operated on the principles outlined, 67% could be taken as a target load for this part of the country. It is here that we hold an important potential advantage over the C.E.A. whose load factor is only 45%. The gas industry figure last year was 54.0% with an average of 57.8% since vesting. Considering the industrial load carried in the North and Midlands these figures would appear to indicate a generous provision of plant in some areas.

Standby Provision

Included in the capital cost of plant is the element of standby provision. Under isolated systems of the older pattern, continuity of production was covered by a considerable duplication of ancillary plant. The advantage to be gained by applying rigidly planned maintenance in reducing standby provision is obvious but integration of manufacture with interlinkage of major works offers a further advantage in plant economy. It is only on a few days in each year that the full capacity of the works is taken up and on all the remaining days, standby production capacity is available at all works. A table included in the address shows the extensive potential standby effect gained by interlinkage of major centres of production and this should be taken into account in the detailed planning of plant installed. During the whole of the three-year period 1955-56 to 1957-58 there were only nine days when demand was within 5% of the production capacity; on ten days there was a virtual reserve capacity of 5-10%; on 67 days a reserve of 10-20%; on 224 days a reserve of 20-30%, and so on. By the continual investigation of performance and the abolition of works 'blindness' the greatest possible productivity can be obtained from working plant and so reduce the capital charges on the product. A recent example of this has been described by E. R. Ward[6] in the work of reforming light distillates in c.w.g. plants. With coke at present prices the water gas therm is no longer attractive, but the use of light distillate can raise the output of these plants by some 25% at a capital outlay of £4 per therm. With the concentration of manufacture it should be possible to recruit engineering and technical staff at the necessary level in order that the pressure of this questing restless spirit of enquiry into our processes should be actively and urgently maintained. Design and operational methods are never final but should be kept fluid by continual investigation and application of new thought.

TABLE 3

APPROXIMATE COST OF GAS MANUFACTURE

	Present Day S.E. England	Range of Costs Major Works: using 1. Conventional Methods 2. Coal Gasification 3. Oil Gasification
	d.	d.
Net materials	6½	4½ — 5½
Process	1½	1½ — 1½
R. & M.	1	½ — ¾
Overheads	1½	½ — ¾
Total	10½	say 7½
Capital		1¾ — 3

(The figures for major scale working carry ample margin to cover additional costs of bulk transmission of gas).

From this study of the factors affecting the capital cost of manufacturing plant, I hope to have shown that with large works linked in an integrated system, capital outlay can be much reduced with a concomitant reduction in process and maintenance charges. In these major centres of production it is clear that we are no longer concerned with the practice of the past in merely repeating standard package units of production. In the selection of plant and operational methods we have entered a new era which is largely concerned with the application of ideas. There are ample signs that a balance of manufacture will be struck between the best of conventional methods, and high pressure techniques for the complete gasification of coal and the gasification of oil, and it may be that approximate equal installations of

the three methods could give maximum flexibility in manufacture and in the utilisation of raw materials. There are two provisos to be ruthlessly applied, they must be sited to advantage and be of major size. The facilities and economies we seek cannot be really obtained at works much below 60 mill. cu.ft. per day capacity. On this scale, on any of the three methods chosen, the capital burden is reasonable. The notably lower capital charges for oil gasification can be ascribed largely to the fact that the handling of solid material is eliminated, the transfer of all materials by pump and pipe lines is a tremendous simplification. The other elements of manufacturing cost would vary with the process adopted, net process materials might vary from 4½d. to 5½d. per therm, process charges from 1½d. to 1¾d., maintenance ½d. to ¾d., and overheads ½d. to ¾d. A comparison can now be made with Table 2, and Table 3 sets out the current manufacturing cost for South-East England with the estimated costs for major scale working on the three methods now available to the industry.

The conclusion can safely be drawn that a modernised gas industry can reduce its cost of manufacture by at least 26%. This condition must greatly enhance the competitive power of gas in the field of energy supply and gives every confidence that the industry can take up its share of the rising national demand for energy.

Never before in the history of the industry have gas engineers been faced with such a clear cut challenge and with it such a tremendous opportunity.

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Report for 1957 of the Water Pollution Research Board

GAS LIQUOR TOXICITY ON FISH INVESTIGATED

RESEARCH into the toxicity of liquors from gasworks and coke ovens, referred to in the 1956 Report of the Water Pollution Research Board, continued in 1957, last year's Report, just published, shows. Special attention was paid to the mixtures of phenols which occur in these liquors. Although phenol itself is the most abundant single substance among the monohydric phenols in liquors from both gasworks and coke-oven works, other phenolic substances—mainly cresols and xylenols—are also present. The toxicity of phenol to rainbow trout has been compared with that of two mixtures of phenol, cresols, and xylenols, the results of which show that the solutions of the phenols present in gas liquors were more toxic than the equivalent solution of pure phenol; 1.0 part by weight of pure phenol was equitoxic with 0.59 part by weight of gas-liquor phenols and 0.71 part of coke-oven phenols.

The toxicity of one of the most important constituents of gas liquors—that is ammonia—is known to be markedly affected by changes in pH value; the toxicity is due almost entirely to the un-ionised ammonia molecule, the concentration of which in a given system increases as the pH value rises. Published work on the toxicity of phenol suggested that the effect of pH value on it was likely to be small but this point has now been investigated by direct experiment. Rainbow trout were exposed to two concentrations of phenol and of mixtures of the monohydric phenols occurring in a gas liquor and a coke-oven liquor, and for each concentration tests were made at three pH values covering the range 5.83 to 8.10. The results show that the toxicity was in no case markedly affected by changes in pH value over this range. Thus the toxicity of the monohydric phenols in a gas liquor or coke-oven liquor will not be greatly affected by the pH value in a stream but the toxicity of a liquor of normal composition will usually be higher, the higher the pH value, since this will increase the toxicity of ammonia.

One effect of the presence of gas liquor in a stream is to reduce the concentration of dissolved oxygen. Moreover, a stream to which the discharge of a gas liquor is allowed is likely to be polluted by other effluents, which will also have the effect of reducing the level of concentration of oxygen. It is thus more important to know the toxicity of the constituents of the gas liquor in water deficient in dissolved oxygen than in water which is fully saturated. Work has now started to determine the toxicity of monohydric phenols at different concentrations of oxygen. Results of experiments made at pH 7.0 and at a temperature of 17.5°C., at concentrations of oxygen between 30% and 100% of the air-saturation value show that the toxicity was greater the lower the oxygen content, but comparison with previous results shows that the toxicity of the phenols was increased to a smaller extent by a given reduction in oxygen tension than was that of un-ionised ammonia; the effect of oxygen tension on the toxicity of mixtures of ammonia with phenols has not yet been investigated.

The Report refers to intensive investigations which both the Gas Council and the National Coal Board are carrying out on methods of treating liquors from gasworks and coke-oven works. One promising process which has been tested in pilot plant, and is in operation on a large scale for the treatment of coke-oven effluents, is biological oxidation by the activated-sludge process. This treatment will oxidise at least a high proportion of the phenolic substances present, and in some plants will decompose thiocyanate. Experiments carried out show that the effect of biological treatment was to remove nearly all the monohydric phenols and thiocyanate, but the concentration of ammonia was not reduced—it was, indeed, expected to increase as the result of decomposition of the thiocyanate. In tests of the toxicity on fish of two liquors treated by this process it was shown that in the first, in which most of the toxicity was due to the ammonia, removal of the phenols caused a negligible reduction in toxicity. In the second liquor, however, the concentration of ammonia was comparatively low, and the toxicity of the liquor was due mainly to its phenolic fraction; when this was removed by biological treatment the toxicity was much reduced. The experiments thus demonstrated that a much greater reduction in the toxicity of gas liquors and coke-oven liquors would result if both ammonia and phenols were removed from them.

The relative toxicity of the phenols and the ammonia in gas liquor depends on the pH value of the water with which the effluent is diluted—that is to say in practice to the pH value of the river to which the effluent is discharged. The higher the pH value of the river the greater will be the relative toxicity of the ammonia. It seems clear, however, that in most circumstances the ammonia will be responsible for a considerable proportion of the toxicity and that it might often be desirable to remove the ammonia by distillation or by some other means from a biologically treated effluent, if the liquor is to be discharged to a stream in which fishing is important.

Some work has been started to ascertain to what extent the results of laboratory experiments on the effects of gas liquors on fish can be used to predict the toxicity of a gas liquor when discharged to a natural stream. These suggest that it should be possible to predict with some confidence whether or not a given concentration of a gas liquor of known composition is likely to be toxic to fish. The survey is being continued to see how accurate a forecast of toxicity is possible from a knowledge of the chemical condition of the water.

James Clayton Lecture*

LARGE PIPELINE PROJECTS

by A. C. HARTLEY,

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PIPELINES have been most extensively developed in the United States and Canada owing to the early growth of the oil industry and the great distances without the alternative sea transport. In the Near and Middle East, apart from the necessity for getting the oil to the Persian Gulf, major pipelines have been developed to enable oil to be loaded at the Mediterranean coast and so avoid the longer haul by sea around Arabia and the payment of Suez Canal dues. In Britain, the development of the pipeline has lagged behind owing mainly to the geographical fact that no part of the country is very far from water transport.

Large pipeline projects, in addition to transporting the oil from end to end of the line, have to include gathering systems from the wells, storage tanks, and means of delivery to the refinery or to the ships which will take it to the refinery. They also provide means for the distribution of products to the markets. Vast quantities of natural gas are transported by large-diameter long-distance pipelines.

Military requirements were met by the construction of pipelines during the 1939-45 war, for the campaigns in Africa, France, and Belgium to supply the advancing armies and also for the campaigns in the Far East. Pipelines were also laid across England to enable oil landed at the West Coast ports of the Bristol Channel and the Mersey to be delivered to the rest of the country. These lines were eventually extended to the Continent by the 'pluto' pipelines laid across the English Channel from Dungeness to Boulogne, and on by further land line into Germany.

There was an urgent need for pipelines, after Colonel Drake discovered the first natural oil well at Titusville in Pennsylvania in 1859, owing to the immediate and increasing demand which made the usual method of transport in wooden barrels by water, horse-drawn wagon, and rail wagon totally inadequate. After some unsuccessful attempts to use gravity flow through wooden pipes as used at that time for water, an attempt was made in 1862 to use pump pressure through a 2-in. cast-iron line 5 miles long, but this failed completely at the lead-packed joints. Advances in mechanical engineering soon produced better joints and, by 1865, a line 6 miles long was constructed over hills and through valleys using 2-in. diameter cast-iron pipe with screwed joints. Three steam-driven pumps at intervals along the line enabled it to deliver 70,000 gal. a day—a throughput which, with wooden barrels, would have needed 300 haulage teams working 10 hours a day and every day of the week. The economy of pipelines was so clearly demonstrated that attempts at sabotage by the displaced teamsters caused serious difficulties for many years.

Further lines were laid during the next few years on the surface of the ground, but considerable trouble was experienced owing to expansion in summer buckling the pipe and contraction in winter pulling the joints apart. These experiences led in 1879 to the burying of a pipeline in a trench across 125 miles of rough country including the major ranges of the Alleghanys. Eight years later, this line was extended to the sea coast at New York and included the remarkable feat of laying 5 miles of line under sea water across the bed of Newark Bay and Staten Island Sound, by screwing together the pipe on barges, attaching floats, and lowering to the bottom in 1,000-ft. lengths.

Many more pipelines were built and advantage was taken of engineering advances to replace cast-iron pipes by wrought-iron and later by steel lap-welded pipe. By 1910 with the discovery and development of oilfields in South America, U.S.S.R., Rumania, Borneo, and Persia, in addition to the vast expansion in the United States, 20,000 miles of pipelines were in operation.

A British company, the Anglo-Persian Oil Company—later the Anglo-Iranian Oil Company and now the British Petroleum Company—took advantage of pipeline developments in the United States and themselves introduced notable developments which enabled them to construct a pipeline system capable of delivering 400,000 tons a year by 1911, 3 mill. tons by 1917, 4½ mill. tons by 1926, and nearly 6 mill. tons by 1930.

After the end of the war in 1918, a large programme of pipeline extension had to be undertaken and as the cost of pipe was then high compared with the cost of pumping plant, it was decided to install three intermediate boosting stations at suitable sites from 30 to 40 miles apart and to lay further lengths of 10-in. and, for the first time, 12-in. pipe, which had become available. The company made a complete departure from American practice, where reciprocating pumps had always been used, and in fact were universally used for many years later, by deciding to install centrifugal pumps driven by steam turbines. Although they have the disadvantage of lower efficiency, they have so many advantages in operation and maintenance and have been so successful, running at times more than two years without a stop, that they have been used for all future extensions. The first type, of which 16 were installed, had a capacity of 2 mill. gal. a day and the later type, of which 4 were installed, with more efficient geared turbines, had double that capacity.

During this period, the problem of corrosion of the lines became very serious in the salty parts of the desert and a very costly anti-corrosion programme was embarked upon. The pipe was lifted out of the ditch at three-yearly intervals, cleaned, scraped, and repainted and efforts were made to sweeten the soil around the pipe by throwing it up in a ridge alongside the pipe and allowing the rains to wash it free from salt.

Toward the end of this period, British lap-welded screwed pipe 12 in. in diameter up to 0.375 in. wall thickness made from steel with an ultimate strength of 45,000 lb. per sq. in. and a test pressure of 900 lb. per sq. in. became available. Methods of stringing and screwing pipe were much as before, but the number of joints screwed by each gang was increased from the earlier 40 joints of 8 in. or 60 joints of 6 in. each day to as many as 140 joints of 12 in. Mechanical equipment was now becoming available and the first side-boom caterpillar tractor cranes were put into operation. Welding was introduced for repair work, either by welding around leaky collars or welding patches over corrosion leaks in the pipes and the day of completely welded pipelines without screw joints was approaching. During this period, the total length of line in operation in the United States had risen to 70,000 miles by 1920 and to 112,000 miles by 1930. More than 100 mill. tons of oil a year were being transported.

Between 1930 and 1939 mechanical engineering had provided the petroleum industry with major developments which made larger-diameter and longer pipeline projects economical. Lap-welded pipe was replaced by seamless steel pipe in lengths of up to 40 ft. of improved quality and standardised diameter and wall thickness. Pipe, made by bending steel plate into shape and joining along the longitudinal seam by electric fusion welding, was becoming available toward the end of this period. In the larger diameters, this pipe was much more uniform in thickness than seamless pipe. The development of gas-shielded electrodes made great advances possible and circumferential joints welded in the field soon replaced

* Abstracted by courtesy of the Institution of Mechanical Engineers.

screw joints. Pipe wrapping and coatings were greatly improved and mechanical means were developed for their application. Pipe-carrying transports, ditching machines, side-boom caterpillar tractors, portable pipe-bending machines, and welding machines of improved design were becoming available. This mechanical handling equipment enabled pipelines to be constructed in much shorter time and the result was that many important pipeline projects became economically attractive and were undertaken during this period.

It had previously been the practice to add an extra thickness called a 'corrosion allowance' to the calculated thickness of pipe to ensure a longer life for a pipeline but this was stopped when protective wrappings became more effective. Improved knowledge of the problems of fluid flow and the availability of higher tensile uniform quality steel pipe with reliable welded joints, enabled designers further to reduce the thickness of pipe and construct larger diameter lines without increasing the quantity of steel used.

Oil had been discovered at Kirkuk and in the early 1930's it was decided that a pipeline should be built to the Mediterranean seaboard at Haifa, a distance of 620 miles, and another to Tripoli, 532 miles, each with a capacity of 2 mill. tons a year. One pipeline with a capacity of 4 mill. tons a year would have been more economical but was politically undesirable. Seamless steel pipe of 10 in. diameter was used for the first 10 or 12 miles on the delivery side of each pumping station, where the pressure was high and pipe 12 in. in diameter was used for the remainder of the line. The ends of each pipe were belled out for a distance of about 6 in. to permit a sleeve of the same diameter and thickness of pipe to be inserted to line up the pipes and at the same time, to provide a backing ring against which a circumferential butt-weld could be made. The pipe was buried and wrapped the whole way; three pumping stations were installed along the part of the line where they were parallel between Kirkuk and the Euphrates.

During this period also, the availability of larger-diameter thin-walled pipe led to the construction of a vast network of pipelines to convey natural gas from the gas fields in Texas and elsewhere in the United States, to its main cities. One of the most notable was a 24-in. line about 1,000 miles long which cost 100 mill. dollars to construct. Ten compressor stations long its main route, using 70,000 h.p., enabled it to deliver 175 mill. cu.ft. of Texas natural gas a year to Chicago and 50 other cities on the way.

Larger pipeline projects played a great part during the 1939-45 war and vast experience was gained in their construction. The largest and the ones which have had the greatest influence on post-war construction were the Big Inch line, 24 in. in diameter and 1,254 miles long, constructed to deliver Texas crude oil to the New York area, started in June, 1942, and finished in August, 1943, and the Little Inch refined products line, 20 in. in diameter, 1,475 miles long. These lines had 24 and 26 pumping stations respectively, each with three 1,500-h.p. electric-motor-driven single-stage centrifugal pumps working in series and with a pressure of 725 lb. per sq. in. delivering at the rate of 15 mill. tons a year of crude oil and 11 mill. tons of refined products respectively.

During the war military rather than economic considerations were all-important and, even where the quantities of products required to be moved in one direction were relatively small, pipelines were laid to avoid the use of packages or bulk road or rail transport and to ensure regular supplies. Indeed, difficulties in ensuring regular supplies by tins, barrels, or 'jerricans,' with losses of more than 50% in extreme cases, led to the laying of pipelines to follow as closely as possible the advance of the armies in North Africa and elsewhere in 1941. These were surface lines with 'victualic' joints of 4, 6, 8, and 10 in. diameter, or buried lines with other types of bolted joint. Petrol- or diesel-engine-driven pumps were installed to boost the oil every 10 or 20 miles or so. The success of these pipelines, and the ever-increasing fuel demands of the modern mechanised army led to a cross-Channel petrol pipeline to supply the Allied armies when the re-invasion of the Continent took place. It soon became clear that the tidal conditions and depth of water in the Channel would make the construction of a pipeline a long operation requiring heavy moorings and a large flotilla of craft if any of the hitherto known methods of laying submarine oil lines were to be used, and that even in peace time weather conditions would make it an extremely hazardous project. In war time the need to stop to make joints would render enemy interference by sea, air, and by the guns on Cap Gris Nez so easy that even given good weather, known methods were clearly impossible. It was the experience with the 3-in. line working at 1,500 lb. per sq. in. in Persia that led to the suggestion that small-diameter pipes in one complete length might be the solution. Two different types of pipe were eventually used and supplied 172 mill. gal. of motor spirit across the Channel.

The successful construction and operation of the Texas to New York Big and Little Inch lines since the war, and the vast network of gas lines in the United States led to the consideration of many new large-diameter pipeline projects, not only in the United States but notably also in the Middle East and in Canada. An important factor was the successful production in 1946 of larger pipes of up to 36 in. in diameter made from higher tensile, or more correctly, higher yield strength steel.

A large pipeline project was the Trans Mountain Line in Canada, 24 in. in diameter, 718 miles long, from Edmonton to Vancouver. A great network of pipelines had been installed in the United States for products and, by careful design of the pumping station to reduce dead ends in the pipework, it is now possible to pump all the distillate products from gas oil to aviation spirit and even butane and propane, through a single line without an unacceptable amount of intermingling. Line pipe produced in this way by submerged arc welding and expanding was not available in Great Britain until November, 1955, but since then large tonnages of 18-, 20-, 24-, and 40-in. diameter pipe have been supplied to oil companies in the Middle East and Canada in about 40-ft. lengths to A.P.I. 5 LX specification.

Another major factor in the economy of pipelines during the last three years has been the successful development of protection against corrosion. Reference has already been made to the great improvement in pipe wrappings and coatings, but it is obvious that even with the greatest possible care there will be some places called 'holidays' by pipeliners, where the protection is damaged either during its application or when laying the pipe into the ditch and backfilling. Experience has shown that in corrosive soils, the corrosion at these holidays is excessively rapid and can cause leaks in a very short time. Great attention was first given to the materials and methods of application of the coatings and wrappings. It was found essential that the surface dirt should be removed from the pipe after it has been welded and that the surface of the pipe must be left dry and clean so as to enable a good adhesive bond for the coating material to be obtained. The cleaning is done by a machine which travels along the pipe under its own power, being immediately preceded by a side-boom tractor which raises the pipe from the skids on to a travelling cradle. The cleaning machine is equiped with rotating heads fitted with combinations of cutters and wire brushes to break up and remove the surface foreign matters. The heads rotate in opposite directions in order thoroughly to clean both sides of the longitudinal weld. Then a coating of bitumen in a quick-drying solvent is applied and the protective coating materials are then applied as soon as the priming solution has dried, but before it becomes brittle.

It has already been pointed out that corrosion can be excessive at the holidays and it has been long established that this occurs where electrical currents leave the pipeline and flow into the soil with the pipe acting as the anode of an electrolytic cell. Corrosion can therefore be stopped by the simple expedient of changing the direction of the current flow and this is what so-called 'cathodic protection' does. Reversal of current has been widely and successfully achieved by means either of the use of sacrificial anodes or application of low-voltage direct current produced from an alternating current supply by means of a transformer and a rectifier.

The capital cost of pipelines makes it essential that they should give continuous service for at least 20 years. Before embarking on a large pipeline project, which may well cost £100 mill. or more, its economics relative to all other possible means of transport must be considered and it is clear that they are essentially different. With gas lines, the decision is easy

because gas cannot be moved in large quantities by any other means such as containers or tank cars, and the problems of the natural gas industry are therefore similar to those long dealt with by the coal gas industry, but with quantities and distances much greater. With oil, there are the alternative batch methods of transport in road and rail tankers and in sea-going and coastwise barges and tankers.

The cost per ton-mile of pipeline transportation is, except for very small quantities of oil, lower than that of rail or road transport, but even with the largest diameter pipelines practicable today, the cost does not come down to the level of ocean-going tankers for the same length of haul. This statement has been true throughout the past 30 years or more at each stage of the development of pipeline and ocean-going tanker transportation.

When it has been decided to go ahead with a project, the route must be carefully surveyed to determine what are the natural obstacles to be crossed and the general direction of the line. The pumping of a specified quantity of a given oil over a given distance may be achieved by larger-diameter lines with smaller pressure drop or smaller-diameter lines with greater pressure drops. A large pipeline will involve higher capital cost and lower running costs and a smaller pipe smaller capital costs and higher running costs. An economical balance must be struck between these two alternatives and unfortunately no hard and fast rules can be laid down.

Reference has already been made to the pumping of refined products ranging from aviation spirit to gas oils, and even butane and propane, and steps must be taken to minimise contamination or co-mingling between succeeding batches of different products or different ownership. This is a function of the velocity and it is essential to keep the Reynolds number as high as possible and ensure turbulent flow. Product lines are therefore generally smaller than crude lines. In some cases, metal plugs, known as 'go-devils' or 'batch pigs' are used to separate the products in the line, but if they tend to stick in a rough line, they may increase the contamination. The modern tendency is to rely on careful design to avoid pockets and to adhere to a rigid operating cycle enabling any small amount of co-mingled product to be degraded to the next product.

Design problems encountered in gas lines differ considerably from those of crude oil lines. A simplification results from the negligible weight of the gas as the pressure in the line is virtually independent of ground elevation. On the other hand, the compressibility of the gas introduces a serious complication the density decreasing and consequently the volume rate of flow increasing in the direction of flow. Whereas in an oil line of constant diameter laid on level ground the pressure decreases uniformly with distance, in a gas line it decreases according to a parabolic law, the pressure gradient becoming progressively steeper.

Another essential difference arises from the characteristics of gas compressors. Oil pumps can be made to generate any desired pressure and boosting stations on oil lines are always sited at such a point that their suction pressure is small—say, 10-50 lb. per sq. in. Gas compressors, however, perform at their maximum efficiency when the ratio of discharge pressure to suction pressure lies between certain limits; 1½-2 in. the case of centrifugal machines and about 3-7 in. the case of reciprocating compressors. A gas-boosting station must, therefore, be sited in accordance with these requirements.

As a result of this characteristic of gas compressors, and of the parabolic pressure gradient, it is not possible to relate pipe diameter to gas line capacity without reference to route length, in the way that is possible for oil lines.

As one would expect from the very different densities, the capacity of a gas line in terms of calorific value transported is greatly inferior to that of an oil line. One mill. cu.ft. per day of natural gas is equivalent in heating value to 10,000 tons per year of fuel oil, so that a 16-in. line 100 miles long capable of transporting 4 mill. tons per year of oil, would only, if carrying gas, transmit the equivalent of 1 mill. tons.

Epikote Resin Paints on the Gasworks

THE French gas industry has already reported on the use of epikote resins for the internal protection of gas mains. And a general review of epikote-resin based coatings, by D. H. Nicholson, appeared in a supplement of the March, 1957, issue of *Corrosion Prevention and Control*. A series of these resins is now available on a commercial basis from the Shell Chemical Co., Ltd.

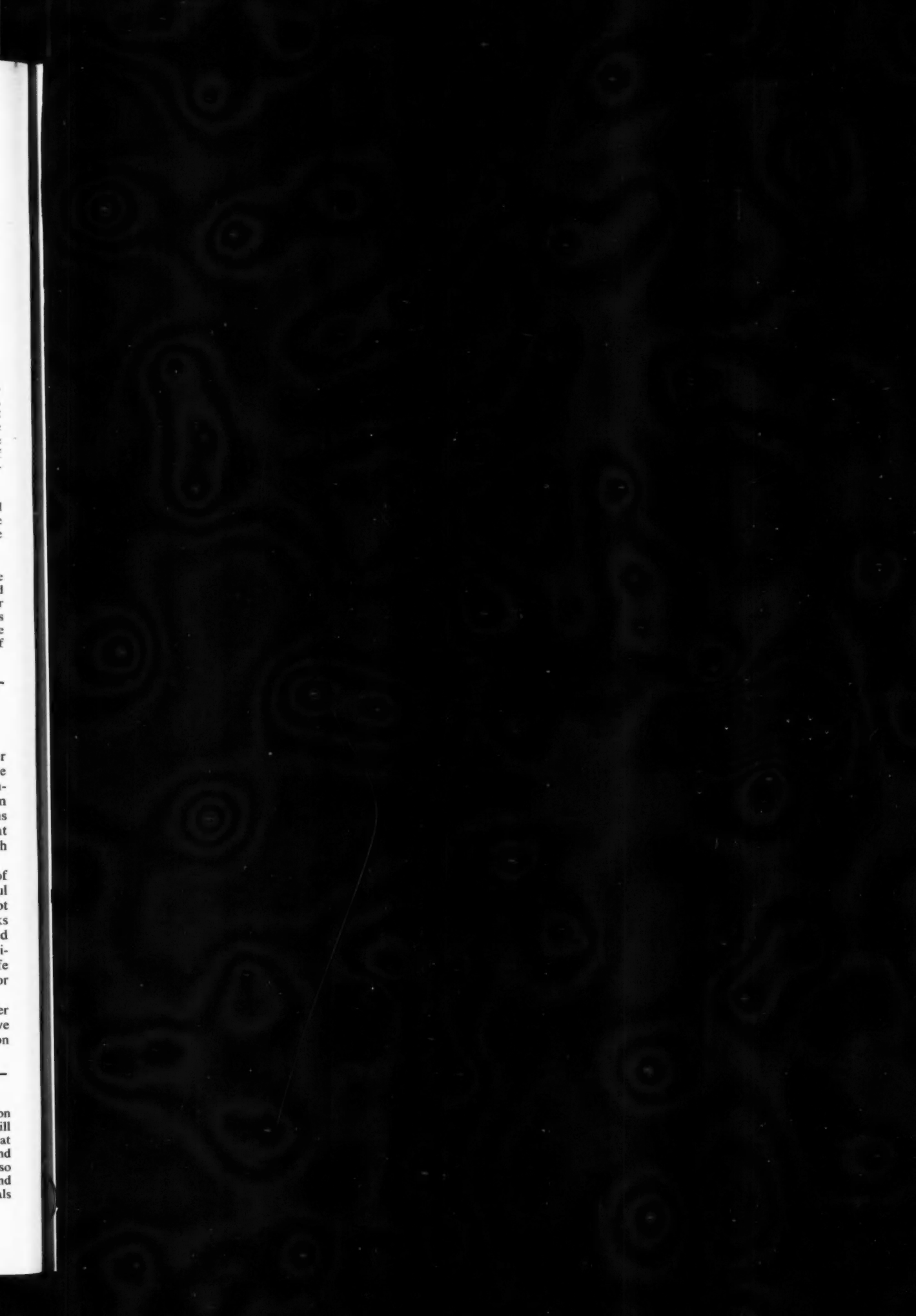
Paints which are mechanically tough with good adhesion to metals and with a resistance to strongly corrosive chemicals are obviously of very great interest to the gas industry. The epikotes (the word is a trade name) are not a single definite compound, but a series which need selection and modification to suit the particular application. Many successful applications have been made to steel structures, for example, tanks containing such corrosive materials as tar acids, alkalis, concentrated sulphuric acid and strong caustic soda solution. An exhaustive series of tests, in co-operation with a Company engaged in the production of coal tar distillates, has been carried out by Mody & Co., Ltd., using protective coatings based on epikote resin. Simon-Carves, Ltd., have also used epikote resins for the lining of gas washing plant and for the protection of rotary ammonium sulphate driers.

An interim report has now been made of investigation into the problem of protecting water-sealed gasholders by the West Midlands Gas Board. Initial trials began in May, 1954, on the lower rings of a gasholder at Windsor Street, Birmingham, followed by further trials on another holder at the same works in 1955.

These trials proved so satisfactory that an extended series of trials have now been arranged on two new holders (at Leamington and Walsall) and one pre-war 'oily' holder at Smethwick. In order to compare different makes, five paint manufacturers are taking part in these trials in combinations of two manufacturers to each holder. And in order to eliminate differences of atmospheric conditions round each holder, their paints will be applied in eight vertical strips round the periphery of the holder, each manufacturer being responsible for alternate strips.

Summing up, the report says that: 'While the use of epoxy-resin based paints had been particularly successful in the application mentioned, the paint systems do not seem to be so generally successful on other gasworks plant. The extra cost of the paints, the precautions needed in surface preparations, and the care needed for paint application have not, in some instances, been offset by a life longer than that given by conventional linseed oil or synthetic-resin based paints.

'The systems adopted by most manufacturers are better carried out on completely bare metal and this may prove difficult to obtain on old painted structures, or even on new red lead, shop-coated structural steel.'

Education Committee Year Book

Principal contents of the 1958-59 edition of the 'Education Committee Year Book,' to be published in September, will include information on all education committees in Great Britain and give lists of secondary and technical schools and colleges, universities, and training colleges. There will also be special sections on technical education, adult education and vocational training, physical and health education, school meals service, and school broadcasting and visual education.